

Naval Surface Warfare Center Carderock Division

Bethesda, MD 20084-5000

NSWCCARDIV-TR-96/016 October 1995

Machinery Systems/Programs and Logistics Directorate
Research and Development Report

Potential Benefits to Navy Training Programs Resulting from Increased Use of Interactive Electronic Technical Manuals

Phase I - Initial Evaluation of IETM Applicability to Schoolhouse and Worksite Training Functions

by

Eric J. Jorgensen

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Samuel C. Rainey (Support Systems Technology Corp.)

Theodore J. Post (Support Systems Technology Corp.)

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE October 1995		3. REPORT TYPE AND DATES COVERED Interim; March 1995 through October 1995	
4. TITLE AND SUBTITLE Potential Benefits to Navy Training Programs Resulting from Increased Use of Interactive Electronic Technical Manuals - Phase I				5. FUNDING NUMBERS	
6. AUTHOR(S) Eric J. Jorgensen, Joseph J. Fuller, Samuel C. Rainey, Theodore J. Post					
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Attn Code 182 Naval Surface Warfare Center Carderock Division Bethesda, MD 20084-5000				8. PERFORMING ORGANIZATION REPORT NUMBER NSWCCARDIV-TR-96/016	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Attn N813 Chief of Naval Operations 2000 Navy Pentagon Washington, DC 20350-2000				10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.				12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) This report summarizes Phase I of a study entitled Training Benefit Analysis of the Accelerated Use of Interactive Electronic Technical Manuals (IETM's). An initial evaluation of the interactive, computer-controlled display of technical information has been carried out by the Navy training community. Results indicate the use of IETM's, integrated with automated courseware, could significantly improve training processes. Forty-seven candidate projects covering surface, air and submarine warfare areas were identified. Fifteen IETM hypotheses and associated implementation scenarios were evaluated. Of these, twelve were supported by more than two-thirds of the participants in this study. Candidate projects were identified for business-case-analyses to be performed in Phase II. This report also identifies technical and administrative issues which must be addressed before the full potential of IETM's can be realized. Measures needed for greater integration, infrastructure support and standardization of IETM's in training are recommended. Phase II of the study will consist of a more detailed analysis of the selected candidate projects, particularly from the standpoint of return on investment. This will provide the Chief of Naval Operations with the basis for training input to the Program Objective Memorandum (POM) '98 preparation process.					
14. SUBJECT TERMS IETM training technical manuals				15. NUMBER OF PAGES 119	
				16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT SAR		

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ABSTRACT

This report summarizes the first phase of a study entitled *Training Benefit Analysis of the Accelerated Use of Interactive Electronic Technical Manuals (IETMs)*.

An initial evaluation of the potential effectiveness in Navy training of the use of the interactive, computer-controlled display of Technical Information has been carried out. Results indicate a widespread agreement in the Navy Training Community that the use of IETMs, integrated with automated courseware, could be of significant benefit in producing greater effectiveness in training procedures.

Fifteen IETM-use "Hypotheses", together with associated implementation scenarios, have been evaluated by the Training Community. In a detailed review, twelve of these possible applications were supported by more than two thirds of the participants; some by more than 90 percent.

Forty-seven Candidate Projects for specific applications of IETMs in Navy training use have been elicited from Surface, Air, and Submarine warfare areas of the Navy. These Candidate Projects, which are summarized in this report, have been reviewed by the study team and found to provide a sound basis for the business-case-analysis phase of the study.

This report also summarizes a number of technological and administrative issues, identified by the Training Community, which must be addressed prior to realizing the full potential of IETMs in Navy training. Measures needed for greater integration, infrastructure support, and standardization of IETMs in training are recommended.

Phase II of the study will consist of a more detailed analysis of the selected Candidate Projects, particularly from the standpoint of Return on Investment, to provide the Chief of Naval Operations with the basis for a training input to the Program Objectives Memorandum for FY 98 (POM '98) preparation process.

ADMINISTRATIVE INFORMATION

The work presented in this report was accomplished under the sponsorship of the Chief of Naval Operations N813 (Manpower, Personnel, and Training Branch of the Resources, Warfare Requirements, and Assessment Division) and N71 (Training Assessment and Education Division of the Office of the Director of Navy Training) under Work Unit No. 1-1820-516.

1.0 BACKGROUND

1.1 IETMs AND THE ADVANCE IN TRAINING TECHNOLOGY

Repeated tests, carried out during the last several years, both under operational conditions and in the Schoolhouse, have shown the efficacy of presenting Technical Information electronically, on an interactive basis, to the maintenance technician, the system operator, and the trainee. It has been demonstrated that the use of such Interactive Electronic Technical Manuals, or IETMs¹, can increase performance levels of inexperienced technicians to that of experienced technicians in complex tasks (e.g., fault isolation) and, correspondingly, can reduce the time required to provide a student with a given level of technical competence.

Concurrently, the technological revolution of the past decade in small-computer capability has made available powerful new automated techniques for constructing courseware [e.g., the Authoring of Instructional Material (AIM) system] both self-paced and instructor-presented.

Also as a result of this technological leap, associated methods (frequently involving electronic displays of Technical Information) for Computer Based Training (CBT), Computer Assisted Training (CAT), and Computer Managed Instruction (CMI) have been developed and put into use. The "Electronic Classroom" has been established at several training facilities; e.g., Great Lakes Naval Training Command and the AEGIS Training Center.

However, these technologically based potentialities, even though they have been reduced to practice in specific cases, have not been fully analyzed in terms of:

- a. The full spectrum of applicability for all phases of the process of Navy training.
- b. The potential advantages that might accrue through integration of IETMs and other major technological advances; e.g., telecommunications, Virtual Environments, Expert Systems, and improved database management.

1.2 DOWNSIZING OF THE NAVAL SHORE ESTABLISHMENT AND THE NEED FOR GREATER EFFECTIVENESS IN TRAINING

Recent reductions in DOD budgets have resulted not only in overall reduction in the number of Navy personnel and weapon systems, but also in the number of training facilities and training personnel. Schools have been combined or eliminated; the number of instructors in most schools has been or is being reduced; and time made available for training in the career of enlisted technicians will be cut back.

Thus, the need to maximize the effectiveness of Schoolhouse and On-the-Job Training (OJT) has become critical. Existing Activities must provide an increased student throughput, in a shorter time, with fewer resources. The increased application of the Interactive Electronic Technical Manual, integrated with other available forms of computer-driven training

¹Expanded definitions of this and other terms used in this report are given in Appendix A.

automation, offers an important contribution to this needed increase in Navy training-system efficiency.

1.3 APPLICABILITY OF IETMs TO TRAINING

Technical Manuals for maintenance, system operation, and other aspects of system logistics (e.g., illustrated parts breakdowns) have always served as textbooks in C-Schools and for applicable job-site training. In using such TMs, schools have been required to abstract appropriate materials from large quantities of paper volumes, to store them, to make them available to a continuous stream of students, to keep the material current, and to prepare visual aids and other supplementing training materials on a continuing basis.

The advent of the IETM, properly designed for training from the outset, offers relief for all of these functions, some of which are extremely time-consuming and impose heavy requirements on both personnel and facilities. In addition, the electronic display of Technical Information offers capabilities (videos, sound, virtual environments, prompting, practice routines, help capabilities, personalized note-taking, etc.) which are simply not available with paper materials.

Finally, the IETM can be profitably coupled directly with other training systems, such as automated courseware preparation, course management, telecommunications, information management, and database systems, in a way that permits significant increases in the effectiveness of all phases of training, from A-School to on-board refresher training.

1.4 TRENDS IN NAVY TRAINING AUTOMATION

A number of efforts have been initiated throughout the Navy, by system acquisition managers, by the schools, and by Fleet Training Activities, to exploit the capabilities of IETMs. Navy system contractors, aware of the savings to their own manufacturing and information-management functions, have been urging this technology on the Navy in a number of cases. However, these efforts, which, on many occasions, have achieved specific improvements in training effectiveness, have so far been carried out on an uncoordinated, non-standard basis.

1.5 NEED FOR AN OVERALL ANALYSIS OF IETM-BASED TECHNOLOGY IN NAVY TRAINING

The Chief of Naval Operations (N71 Director of Naval Training and N81 Resources, Warfare Requirements and Assessments Division) has recognized the need for a comprehensive analysis of these factors, an analysis which would encompass the entire Navy Training Community and consider the complete spectrum of potential benefits that could accrue from increased use of Interactive Electronic Technical Information presentation in Navy training.

The current study represents the initial phase of such an analysis and takes into account the following major technological and organizational developments:

- a. The emergent capabilities on a broad front for instituting proven technological advances for the improvement of Navy training.

- b. Widespread reorganization, redefinition, and downsizing of the Navy's training mission.
- c. The rapidly increasing implementation of a series of uncoordinated efforts to create greater training effectiveness in various Schoolhouse and Fleet Training Centers and by various Program Managers.

2.0 ASSIGNMENT OF THE CURRENT STUDY

2.1 PURPOSE

To assess the capability of interactive electronic display of Technical Information on an organized basis in all aspects of Navy training, particularly through integration with other advanced technologies, the Office of the Chief of Naval Operations (N71 and N81) tasked the Naval Surface Warfare Center, Carderock Division (NSWC/CD), with conducting a two-phase study. The purposes of the study were to:

- a. Survey the spectrum of potential benefits to Navy training resulting from the increased use of IETMs and estimate both potential cost avoidances and shortening of the Navy training pipeline resulting from IETM use.
- b. Provide a basis for OPNAV training input to the Program Objectives Memorandum (POM) to maximize the early implementation of IETMs in training.

2.2 OBJECTIVE, SCOPE, AND TASKING

The assigned objective, scope, and tasking of this study are as follows:

2.2.1 *Objective*

The objective is to determine the investment opportunities and impacts (e.g., knowledge retention, costs, time to train, method of delivery) to the Fleet and shore training establishment of accelerating the implementation of IETMs in the classroom and the Fleet.

2.2.2 *Scope*

The scope of this analysis is to include equipment maintenance and operation in the Air, Surface, and Submarine communities of the Navy. The study will consider combining separate training programs for different ratings and/or specialties within ratings, expanding on-the-job training programs, and increasing the scope of job-performance aids in the IETM packages. Phase I of the assessment will apply broadly to all parts of the Navy with the aim of identifying a smaller number of potential high-payoff areas for more detailed assessment in Phase II. While all benefits and savings will be addressed, emphasis will be placed on the particular savings in reducing the training pipeline without compromising quality.

2.2.3 *Requirements/Tasks*

The study is planned as a 12-month, two-phase effort. The objective of the first phase is to survey the Navy broadly, looking for high-payoff training opportunities for further study. The second phase will conduct further study on a selection of these high-payoff training opportunities. An additional objective of the second phase will be to obtain a high-level assessment as to the possible total benefit of a Navy-wide implementation of the IETM technology for job-aiding and on-the-job training.

2.3 PLAN OF ACTION AND MILESTONES

The Plan of Action and Milestones for Phase I of the effort (see Table 1), was delivered to OPNAV on 3 April 1995. This study plan has been followed closely, with frequent meetings between NSWC/CD and OPNAV to discuss progress.

2.4 PHASE I APPROACH

The first phase was planned as a four-month effort. It has consisted of the following efforts.

- a. Training Activities were identified from all parts of the Navy to include most large programs from Air, Surface, and Submarine communities.
- b. Site visits to a number of these program offices were conducted to identify such aspects as:
 - (1) How TMs are used in training;
 - (2) Length of Schoolhouse training;
 - (3) Extent of specialized training for different ratings or occupational specialties;
 - (4) Identification of opportunities to replace classroom training with OJT and job-performance aids using IETMs;
 - (5) Identification of the windows of opportunity for changing the training system;
 - (6) Possible changes in the maintenance philosophy not requiring reengineering of the equipment; and
 - (7) Other aspects needed to identify opportunities for training improvement
- c. A series of 15 "Hypotheses", suggesting potential benefits to the Navy's Schoolhouse and Fleet training programs resulting from accelerated use of IETMs, were prepared for assessment by a large cross-section of the Navy Training Community. Appropriate Implementation Scenarios and proposed Measures of Effectiveness were also established to provide a comprehensible context for these Hypotheses.
- d. A three-day Workshop was conducted, the objectives of which were to:
 - (1) Review and validate a set of Hypotheses and associated Scenarios (provided separately to participants).
 - (2) Assess benefits to Navy training programs resulting from an increased/accelerated use of IETMs.
 - (3) Identify a slate of high-payoff opportunities in IETM technology with demonstrable benefits to the Training Community with near-term payoff.
 - (4) Obtain specific information on current training procedures and applicability of IETMs to Navy training programs.
- e. To permit the selection of high-payoff Candidates, a set of "Selection Criteria" was established to indicate the qualities needed in such specific cases.
- f. Candidate submissions were requested, prepared, and assessed.

Table 1. Plan of Action and Milestones, Phase I Study; Training-Benefit Analysis of the Accelerated Use of IETMs

TASKS	PERIOD OF PERFORMANCE				
	MARCH	APRIL	MAY	JUNE	JULY
1. Start Work	■ 3/7/95				
2. Conduct Kickoff Meeting	■ 3/9/95				
3. Survey & Scope Project	■	■			
4. Prepare & Deliver POA&M	■	▲ 4/3/95			
5. Select & Schedule Site Visits	■	□			
6. Conduct Site Visits		■	□		
7. Plan & Conduct Workshop		■	■ 24-26 May		
8. Analyze Results		■	■		
9. Prepare Report				■	▲ 7/7/95

LEGEND

■ Continuous Activity

▲ Deliverable

□ Memo Reports

■ Major Event

Date -/ Start or Due Dates

2.5 PHASE II PLANS

As stated in the study tasking (par. 2.2.3), Phase II will consist of an 8-month effort in which the most suitable Candidate Projects submitted at the Workshop will be subjected to more detailed analysis in order to:

- a. Identify those Candidate Projects which represent the greatest demonstrable potential for IETM use in training, across a spectrum of applications.
- b. Establish the magnitude of cost avoidance and training-pipeline improvement in terms of numerical Measures of Effectiveness for these Candidate Projects.
- c. Provide recommendations to OPNAV N71 and N81 as to input for forthcoming POMs in the area of training automation.

A Plan of Action and Milestones will be developed and submitted early in Phase II.

3.0 HYPOTHESES AND IMPLEMENTATION SCENARIOS FOR POTENTIAL IMPROVEMENTS IN NAVY TRAINING DUE TO USE OF IETMs

3.1 THE HYPOTHESES

For analysis and assessment purposes, 15 "Hypotheses" were developed, stating that IETM use would improve specific aspects of Navy training. Each of the Hypotheses was accompanied by:

- a. Discussion to clarify the meaning, application, scope, and experience with respect to IETM use cited in the Hypothesis.
- b. A proposed Implementation Scenario, summarizing steps and actions required to put the particular IETM aspect into operation.
- c. A proposed Measure of Effectiveness (MOE) stated in terms which could be quantitatively measured by detailed analysis (e.g., reduction in course time, specific cost avoidance, elimination of specific facilities).
- d. A goal considered in terms of the MOE, to be established by consensus of members of the Training Community (during site visits and, primarily, at the Workshop).
- e. A statement concerning acquisition and life-cycle support investments likely to be required to implement the particular IETM function dealt with in the Hypothesis. (During Phase I, no attempt was made to actually estimate costs for the specific IETM and related functions discussed.)

3.2 HYPOTHESIS CATEGORIES

Table 2 shows the general categories of training and associated functions covered by each Hypothesis.

3.3 INDIVIDUAL HYPOTHESES AND SCENARIOS

The 15 Hypotheses evaluated during Phase I of the study are included in this section, along with the accompanying explanatory material. These Hypotheses were widely distributed for assessment throughout the Navy Training Community.

Table 3 illustrates the information requested for all of the 15 Hypotheses in the five-page evaluation form used for the assessment of the Hypotheses. The 15 Hypotheses, together with the associated amplifying material used for the evaluation are presented on the following pages. Results of this assessment are given in section 5.

**Table 2. Categories of Training Functions
Covered by the Hypotheses**

General Training Function	Hypotheses
Shift of Training from Schoolhouse to Fleet	1, 11
Improved Efficiency in Schoolhouse Training	2, 13
Improved Efficiency in Course Material Preparation	3, 4, 5, 15
Reduction in Need for Training Support Equipment through Use of Virtual Environments	6
More Efficient Scheduling for Technician Assignments	7
Reduced Risk of Combining Ratings	8
Assists Consolidation of Training Facilities	9
Reduces Size of Training Plant	10
Achieves Higher Level of Classroom Utilization	12
Improves Distance Learning	14

Table 3.

Sample Hypothesis Evaluation Form

NAME: _____ **ACTIVITY:** _____

HYPOTHESIS: 1. The use of IETMs at Fleet work sites permits transfer of many types of procedural training from Schoolhouse to OBT, thus reducing Schoolhouse curriculum length.

1. Generally support ☐ Reject ☐

2. Proposed modification to Hypothesis or MOE: _____

3. Potential for significant payoff (scale of 1-5). Circle one:

(Low) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (High)

4. Suggested goal. Without decreasing Fleet performance quality, reduce Schoolhouse procedure-training time by:

☐ Less than 15% ☐ 15%-35% ☐ 35%-55% ☐ Greater than 55%

5. Comments: _____

1. Amount of Procedure Training in the Schoolhouse

Hypothesis

The availability of easy-to-use IETMs in the Fleet maintenance and operational sites permits the transfer of training from the Navy schoolhouse to the work site for many types of procedural activities, thus reducing length of the schoolhouse curriculum and shortening the training pipeline.

Discussion

Many highly proceduralized processes are currently taught in the schoolhouse, such as alignment procedures, for which accurate long-term memory retention is near impossible for most sailors. These procedures are best taught shortly before the actual time the individual is able to perform the specific task. For most students, the lessons learned in the classroom are forgotten by the time they are confronted with the actual situation and their procedures must be reviewed in a Technical Manual, which is often not well adapted to procedural instruction. The concept of this hypothesis is to train the student how to use the IETM (a relatively short time period) and provide the student with a supportive and easy-to-use proceduralized IETM for use in the operational site.

Scenario

Establish criteria for forms of procedure training which can be reallocated from Schoolhouse to IETM-supported performance in the Fleet.

Identify the affected procedures and develop training-supplemented IETMs which provide detailed step-by-step guidance for each procedure sufficient to ensure high quality maintenance.

Eliminate from schoolhouse curricula such forms of procedure training except for safety-sensitive procedures.

Measure(s) of Effectiveness

Schoolhouse time given to procedure training.

Time to successfully perform the required procedure under operational conditions.

Goal

Reduce schoolhouse procedure training time by ____% while maintaining equivalent time to complete procedure under operational conditions.

Investment Required

Analysis and revision of curriculum, instructors guides, and student guides.

Preparation of proceduralized IETMs for displaced (now in-service) training.

Follow-up validation to ensure that on-the-job performance is not negatively affected.

2. Time Needed for Students to Achieve Specified Proficiency

Hypothesis

As student reference material, IETMs are more effective teaching aids than paper TMs and therefore will reduce classroom time required to bring students to a given level of proficiency.

Discussion

IETMs have several characteristics that make them more effective as teaching aids than conventional paper TMs, especially the rich use of illustrative graphics, as well as, the "chunking" of the text into succinct word statements displayed with related graphics which include only detail relevant to the text. Additionally, IETMs utilize automated accessing capability such that required information can be located more rapidly with an IETM than with a conventional TM. Much of the time in using a paper-based TM, whether in a class or on a ship, is in the time to access the right material. It is expected that classes which spend a great deal of their time on theory of operations have the most to gain through the use of IETMs. Animation and rotatable 3-D graphics may have the biggest (positive) impact.

Scenario

Develop graphics-intensive IETMs with embedded training aids such as 3-D graphics and animation for the subject matter.

Revise and shorten curriculum, using the IETM as the primary training aid.

Conduct classes with IETMs.

Measure level of proficiency of IETM-trained graduates compared with conventional class graduates.

Measure(s) of Effectiveness

1. Instruction time to teach a subject
2. A specified level of proficiency in the subject matter
3. Academic attrition in a specific course

Goal

Reduce instruction time by ____ % to maintain the same level of proficiency.

Reduce academic attrition for a specific course by ____ %.

Investment Required

Develop graphics-intensive IETMs.

Revise curriculum, instructors guides, and student guides based in IETMs.

Perform validation of test to assure that the level of proficiency is not negatively affected.

3. Development and Life-Cycle Support for IETM-based Training Information

Hypothesis

The time and cost for the course development, preparation, and revision of the instructors guides, student guides, and associated training materials will be greatly reduced with the integration of the Navy AIM (Authoring of Instructional Materials) System and the IETM as compared to revising courses using traditional paper TMs. Additionally, the cost of distribution, storage, management and updating of IETM-based training materials will be less than for conventional, paper-based materials.

Discussion

Acquisition and life cycle support of paper TMs and training materials are more costly and time-consuming than for IETM-based alternatives. Specific support functions are cited in the following scenarios along with indications of the possible savings. Savings increase as the number, types, and complexity of training materials increases (the Supporting Information topic below provides an indication of different types of training material). The Navy AIM system for automating the preparation of instructors guides has the ability to be integrated with the IETM to some extent now. To achieve the benefit proposed in this hypothesis, the IETM and AIM should be more fully integrated so that when a new version of the IETM is received, the course curriculum and associated instructors guide can be easily updated to reflect the change in the IETM.

Scenario

Logistics element manager (LEM) develops and maintains the subject-matter IETM throughout its lifecycle.

Training manager working with the LEM develops an automated IETM/AIM interface with the capability to easily revise the course with the receipt of a new updated IETM. (Note this may require some up-front development/enhancement resources to enhance AIM for this purpose.)

All training materials are maintained in digital form and used in automated classrooms (already under development for some Navy schoolhouses.)

Measure of Effectiveness

Process time and costs for acquisition and life-cycle support of each automated training product.

Goal

Reduce life-cycle support costs associated with acquisition and maintenance of training products by ____ %

Reduce logistic time for maintenance (e.g., update) of automated training materials by ____ %.

Investment Required

The acquisition and life cycle costs of IETMs and tools to maintain training materials, e.g., storage for CD ROMs; utilities program for IETM; extra slide-making mechanisms.

4. Efficient Use of Instructors

Hypothesis

The use of IETMs linked to AIM (the Navy's Authoring Instructional Materials system) will improve the efficiency of Instructor utilization during Instructor course preparation and revision.

Discussion

This hypothesis, while related to the one on reduced life-cycle support time and cost, is directed at another resource, namely the efficient use of the instructor when at the schoolhouse. A new instructor spends more time preparing for a course, than actually teaching it. With the recent BRAC initiative it is critical that the ratio of preparation time to teaching time be reduced. The hypothesis states that the integration of the IETM form of technical information coupled with the use on an enhanced AIM is one of the best ways to achieve this efficiency booster.

Scenario

Acquire IETM for targeted course.

Acquire enhanced AIM (allowing integration with the specific IETM acquired).

Conduct Instructor's Preparation and prepare supporting materials using AIM linked to IETMs.

Measure(s) of Effectiveness

Ratio of Instructor-Preparation and product-management time to class time.

Goal

Ratio of time required for Instructor Prep and product management to class time will decrease by ____ %.

Investment Required

Acquire IETM for course subject matter.

Acquire capability to link AIM to specific program IETMs. (May require one-time enhancement of AIM.)

Utilize IETM and enhanced AIM with added utility features for IETM editing (e.g., a "clipboard" function permitting select, cut, paste) in developing new/revised course and associated instructors guide and student guide.

5. Original Preparation of Training Materials

Hypothesis

The availability of IETM-based training materials as source data for classroom training materials requires less time for the preparation of training materials than a conventional process (word processor) working with paper TMs as source data.

Discussion

This hypothesis is related to hypotheses 3 and 4, but is targeted to reducing the cost of preparing the original supplemental training materials, a concern of both the acquisition Program Manager and the Navy Schoolhouse. The realization of this hypothesis may be easier to achieve sooner and with less development investment than the other two which involve a tight integration of an enhanced AIM and the IETM. This hypothesis used the IETM as a rich source for the extraction of digital training materials.

Scenarios

Schoolhouse personnel use IETM and some data-extraction/editing capability, possibly coupled with AIM, to prepare Redline and training support information.

Measure(s) of Effectiveness

Time(in-house)/cost(contract) required for the preparation of training information.

Goal

Reduce the time/cost required to prepare original training information by ____ %.

Investment Required

Editable version of IETM (possible IETM with edit function built in, a feature common with MS/Windows based software.)

Edit/extract software available for use in AIM.

6. Use of IETMs to Provide Virtual Environment (VE) Training

Hypothesis

IETM-based training, through its animation, video, simulation and interactive graphics capabilities (i.e., multi media), can reduce the need for schoolhouse use of expensive mockups, dedicated simulators and real equipment through the establishment of VEs equally useful or superior to conventional training aids.

Discussion

This hypothesis addresses, for the most part, leading edge technologies just now emerging. Simple simulations (e.g., knob turning, digital display emulation) have been available for several years but true virtual environments have been limited largely to systems operators and aircraft pilots. However, as the technology is now being directed at the entertainment market, the availability should be greatly increasing in the very near future. Detailed study is needed but the promise for significant savings is high.

Scenario

Conduct a study to identify candidates for replacing real environment class/lab time with Virtual Environments. Note, that in some cases, VE may fill a void where real environment is desirable but not available.

Evaluate, select, and implement VE technology.

Design appropriate course, instructors guide, and student guide.

Conduct follow-up evaluation to determine adequacy of VE replacement.

VE Training aids of the above types could be included in IETMs and made available to students at workstations on either a self-paced or instructor-sequenced basis.

Measure(s) of Effectiveness

Quantitative requirement for use of dedicated simulators, mockups and actual equipment.

Goal

Reduce requirement for real environment by ____ %.

Investment Required

Creating virtual environments as part of IETMs.

7. Efficient Training Sequencing

Hypothesis

The use of IETMs is a key enabler of more cost effective sequencing of formal training for technicians, specifically: their use permits deferring School Training (C Schools) until after technicians have some IETM-supported, hands-on experience on a weapon system.

Discussion

In a conventional training sequence, the first year or so of a new technician's duty time is spent in compartment cleaning, mess cooking, and On the Job Training (OJT). When coupled with the lengthy, expensive Resident School Training (RST) and low reenlistment rates, the overall productive labor payback is quite low.

This hypothesis involves a building-block approach to job competency consisting of Practical Job Experience (PJE) using IETMs, Self Teaching Exportable Training with IETMs modified to include learning enhancements, OJT (classic over the shoulder), and deferred RST for those who commit to reenlistment. The precedent for this hypothesis is the Enlisted Personnel Integrated Career System (EPICS), based on a study carried out by NPRDC in 1982.

Scenario

Implement a management system for training assignments so that:

- Bootcamp graduates bypass front-end training and go direct to duty station
- New assignees to duty stations split duty time between work supported by IETMs and IETM-based training; work and training become progressively wider in scope and more complex.
- For those whose work, training ratings and reenlistment commitment warrant, a scaled-back RST is provided (work and onboard training reduce need for training).

Measure(s) of Effectiveness

First tour productivity ratio (Available-on-station/tour-length)

Goal

Increase first tour productivity ratio by ____%.

Investment Required

IETMs with Integrated Courseware for Onboard Training

8. Combine Enlisted Ratings

Hypothesis

IETMs reduce the risk of combining related Ratings for enlisted technicians.

Discussion

Factors such as downsizing and budget cuts across the DOD combine to create manpower shortages and to reduce promotion opportunities in technical specialties. Combining Ratings is one way to reduce training costs, but this approach also risks lowering job competence, e.g., the combined course must cover the original number of training topics but in less than the original total time.

The use of IETMs working with other technologies, has the potential both to shorten lengthy, combined curricula, and to reduce or eliminate the risk of low job proficiency of combined-course graduates.

Scenario

When two related technician Ratings are combined into a single Rating, IETM-based training is used to develop and administer the combined schoolhouse course.

IETMs (including learning features) are provided to the graduates of the combined courses to support their work in the Fleet

Measure(s) of Effectiveness

Training and job competency risks of combining Ratings, e.g., percent of trainees/job incumbents meeting minimum proficiency requirements.

Goal

Reduce the training and job competency risks to no more than _____ %.

Investment Required

IETM based training and Fleet IETMs including learning features.

9. Consolidate Dispersed Work

Hypothesis

When work is shifted from several locations to a single location, but when experienced workers do not accompany the work; or when training functions previously dispersed among several activities or Services is consolidated, the use of IETMs reduces the time and cost of the transition training required to successfully handle the increased load.

Discussion

When maintenance functions are relocated but the experienced workforce does not relocate, a major transition training program is typically required. If proceduralized IETMs are developed before the transition, two factors are greatly facilitated. First, the use of the IETM assures that the process transfers as well as the function (the process is documented in the IETM). Secondly, it will be much easier to train the receiving workforce using the IETM. It may even be possible to eliminate the requirement for classroom training, and to use the IETM as a job aid and effectively perform apprentice-like training on the job.

Scenario

Scenario applies when work is assigned to a new maintenance facility for which the current workforce has no or little experience.

Prior to consolidation, a proceduralized IETM is developed by one of several processes which captures the experience of the original workforce experts. In some cases the repair process may have to be reverse-engineered because no written methods exist.

This IETM is augmented for training and used as the basis for the training program for the facility. It also serves as the principal means of refresher training for experienced personnel, typically as OJT and not in the classroom.

Measure(s) of Effectiveness

Cost and time required to meet additional training and work proficiency requirements.

Goal

Reduction or elimination of increases in training time and cost of training staff by ____%.

Investment Required

Preparation of the IETM, preferable before relocation of the maintenance and associated training functions. Cost of reverse engineering of the repair process and the cost of developing and maintaining IETMs

10. Physical Size of Areas Required for TM Storage

Hypothesis

Use of IETM-based training materials reduces the overall size requirement for the physical training plant (e.g., smaller requirement for library, TM storage facilities).

Discussion

The large storage space required for the numerous paper TMs used in schools constitutes a major problem for training activities. The situation is that equivalent amount of information can be stored on a single compact disk (CD) medium all but eliminating this problem. Virtually all of the space required to store (and use) paper TMs could be eliminated with IETM-based training materials. At the developer site, these materials would be recorded on CD ROMs for distribution to using activities. At the user activity, the CD ROM would be loaded onto centralized data bases and users would download via networks to the hard disks of their individual work stations.

Scenario

Implement IETM, training materials, and other information needed in an all-digital medium. The use of IETMs in a physical medium such as CD ROMs will eliminate the requirement for a large central library and other mid- and long-term storage facilities for paper-based information products at the training site.

Establish Central database and network for on-line or off-line access to the IETM information.

Acquire student and instructor workstations which operate in a network or client/server environment for all needed information.

Measure(s) of Effectiveness

Building storage space devoted to Technical Information storage

Goal

Reduce storage space by ____ %.

Investment Required

Acquisition and life-cycle support of Digital IETM based training aids.

For an on-line system, the installation of networked workstation environment

11. Certification Training

Hypothesis

The use of highly proceduralized IETMs, combined with administrative controls to assure adherence to the IETM documented procedure, will enable shifting the Certification training now done in the schoolhouses to the Fleet.

Discussion

Work requiring Certification usually involves hazards to performers/observers or equipment or both. For this reason, the Schoolhouse provides task training to "Certify" that graduates are qualified to perform the task involved. The basis for shifting responsibility for asserting task competence from schoolhouse training to IETMs in the Fleet is the demonstrated capability of IETMs to support timely and accurate performance regardless of amount or recentness of user experience. A means of enforcing use of IETMs is required; e.g., an audit log in the IETM electronic display device; designating the task as "CDI Required".

Scenario

Implementation starts with a task analysis by a Subject Matter Expert to identify tasks requiring Certification; it may include establishment of supporting information such as frequency of re-certification, conditions that will result in the loss of certification, etc.,.

An IETM is developed closely documenting the procedures needed to assure safe and accurate task completion.

Administrative controls and an automated audit train are implemented in the IETM to assure the IETM was actually used in the performance of the task requiring certification.

Regulations need to be modified to allow this alternative mode of operation.

Measure(s) of Effectiveness

Amount of formal Schoolhouse training for Certification.

Goal

Elimination of Certification training in the Schoolhouse for specific tasks.

Investment Required

Task analysis to designate tasks and the preparation and maintenance of suitable highly proceduralized IETMs with built in audit capability.

Appropriate change in formal regulations.

12. Classroom Utilization

Hypothesis

The use of IETM-based classroom training will result in higher levels of classroom utilization.

Discussion

The premise here is that, because they are bulky and hard to move and store, paper-based TMs required for many courses actually tie up classroom space, even when the class is not meeting. This is especially true when the room must be secured for classified courses. The compact electronically-encoded IETM-based training material, often fitting on a single CD-ROM, can easily be secured in a classroom, making it available for use when the first class is not meeting. With an all-electronic classroom, where the information is distributed on-line, there is virtually nothing to store making the room available for alternative use.

Scenario

Acquire IETMs and all training materials in digital form and on a small number of CD-ROMs (or available on-line).

Develop electronic instructors guides and employ them in an electronic classroom.

Implement clean-workstation policy effectively making classroom available for alternative use when class not meeting.

Reschedule classroom based on above policy.

Measure(s) of Effectiveness

Classroom utilization (ratio of utilized classroom time to total classroom time)

Goal

Increase classroom utilization by ____ %.

Investment Required

Cost of acquiring and maintaining appropriate IETMs.

More efficient scheduling process assuming unoccupied rooms are available for rescheduling.

13. Task-Oriented Training

Hypothesis

The use of IETMs allows schoolhouses to convert system-description courses to task-oriented courses. The conversion will reduce training time and increase productivity of graduates.

Discussion

The basis of this hypothesis is that in the real-world Navy environment where many of the available technician are inexperienced, it is more efficient to train based on the specific tasks anticipated vice the conventional training emphasizing a thorough understanding of the system under repair and expect that the technician can perform assigned tasks in an enlightened manner. Proceduralized job aids in the form of IETMs are crucial because task-training alone will not assure retention of the needed task procedures and the on-site job aid will be needed.

Scenario

Institute IETMs and IETM-based task training oriented toward fault isolation and corrective maintenance tasks rather than towards system theory-of-operation.

Train qualified recruits in a task-oriented, IETM-based curriculum.

Assign graduates to duty stations and support them with IETMs to obtain immediate productive work.

Measure of Effectiveness

Duration of front-end schoolhouse training

Task-performance proficiency in the Fleet

Goal

Reduce schoolhouse course duration by ____ %.

Increase job proficiency of newly trained technicians by ____ %.

Investment Required

Acquisition and life-cycle support of IETM-based, task oriented training materials.

14. Distance Learning

Hypothesis

IETM-based training materials supplemented by instructor-student communication capabilities will facilitate and reduce the costs of distance learning.

Discussion

The Navy is proceeding with implementation of distance learning. The thrust of this hypothesis is that the concept will only work well when all the training materials are in digital form and can be downloaded (e.g., in the first few minutes of the satellite hookup) to the student PC-based workstation. Additionally the session will be greatly enhanced if the IETM has been integrated into the remote-session communications so that the instructor can interact with the student workstation application in a fashion similar to the electronic classrooms under development for the schoolhouses. All these benefits would be in addition to the benefits of using the IETM in training which have been addressed in other hypotheses.

Scenario

Construct self-contained IETM-based training materials suitable for on-line downloading via satellite link.

Design distance-learning courses to utilize these materials.

Measure of Effectiveness

Cost for conducting distance learning course

Goal

Reduce cost of conducting specific training courses by ____ %.

Investment Required

Augment existing distance learning investment by acquiring and maintaining IETM and digital training materials for subject matter in a form suitable to be used with distance learning.

The following developmental items, mostly one time, would be required:

Develop/acquire down-load capability to transmit all training materials in one burst to the receiving sites in the first few minutes of the satellite session.

Integration of the IETM into the instructor station in a manner so as to be able to operate over the telecommunication link. Existing technology being developed for electronic classrooms would be used as a basis.

15. Interactive Courseware (ICW)

Hypothesis

The cost of developing ICW associated with, and based on IETMs will be lower than the cost of developing the same course materials with conventional ICW and separately developed paper TMs or IETMs.

Discussion

As both IETM and ICW technologies mature, it is becoming harder to distinguish the two products. This raises the distinct possibility that, if separately managed and specified, there will be a great deal of duplicative material when the two products are procured independently. This thesis contends that IETMs and ICW can be developed or procured as an integrated product and that by so doing significant benefits in cost and usability will accrue.

Scenario

Specify and procure integrated product that performs both the Technical Manual function and the Training function. The IETM-ICW combination will include the capability for generating, assessing, directing, collecting and recording students' progress data.

Measure of Effectiveness

Cost of developing ICW based on IETM-related ICW.

Goal

Reduce combined cost of ICW training materials and IETMs by ____ %.

Investment Required

Acquisition or development and life-cycle support of needed IETM/ICW/CMI combinations.

Policy/administrative modification to facilitate common procurement of IETM and ICW.

4.0 COLLECTION OF DATA

4.1 SITE VISITS

As noted in section 2.4, site visits were made to Fleet Training Activities and other facilities with first-hand knowledge and experience in developing IETM-based training material, in coordinating and establishing its use in Schoolhouse applications, and in applying IETMs in Electronic Classroom applications. The purpose of these visits was to obtain the benefit of this experience in IETM/Training applications, to obtain an initial assessment of the Hypotheses/Scenarios discussed in section 3, and to establish, prior to the Workshop (section 5), any need for changes in the Hypotheses/Scenarios or other study plans.

4.1.1 *Sites Visited*

The ten site visits and the major purpose of each are shown in Table 4. Detailed records were made of discussions at each of the site visits. These were summarized as site-visit summaries, which were used to capture the information developed, and lessons learned, during the site visits.

4.1.2 *Site-Visit Results*

Information of five major types was derived from the site visits, which provided an important contribution to carrying out the study:

- a. A better understanding of current policies and procedures in Navy training, leading to improved awareness of the problems and potentials involved in applying automation to classroom and Fleet training. Of particular importance was the information gained as to the Navy's ongoing active changes in the structure, organization, size, and functions of its Training Activities, objectives, and personnel.
- b. Information concerning the status of automation efforts throughout various Activities of the Navy Training Community, together with information on resources required and effectiveness of automated systems already implemented.
- c. Information leading to the restructuring, refinement, and, in some cases, the further development of the Hypotheses and their associated Implementation Scenarios.
- d. Information leading to a better capability to evaluate contents of candidate submissions; e.g., capabilities, required resources, time requirements, program size and schedule, state of planning, and breadth of applicability.
- e. Information leading to a more realistic set of criteria for selection of candidate efforts for the Phase II study.

**Table 4. Summary of Site Visits Carried Out By Study Team
During Phase I.**

Location / Activity	Summary of Items Discussed
AEGIS Training Center, Dahlgren	Scope of, and approach to, study.
AEGIS Training Center, Dahlgren	Response to Hypotheses; Electronic Classroom.
TRACOR Facility, St. Inigoes, MD (AEGIS)	Experience in IETM use in AEGIS training.
NAVAIR, PMA 205	NAVAIR IETM/training-projects experience; automated training technology.
ManTech, Alexandria, VA	Use of AIM in preparing ICW.
PMO 418 (AN/BSY-2)	Experience in use of IETMs in AN/BSY-2 training.
Sikorsky Aircraft	Integrated Support System (ISS) and IETMs. Expert Systems applications to IETMs.
Great Lakes Naval Training Center	Experience in LM-2500 IETM use for training. Overall Navy training projects. Electronic Classroom.
OPNAV N431T and PMS 335G	Regional Maintenance Centers.
CNET/Pensacola	NAMTRAGRU initiation of Electronic Classroom (ECR) program.

4.2 THE IETM/TRAINING BENEFITS WORKSHOP

The planned IETM/Training Benefits Workshop (par. 2.4 d.) was held 24-26 May 1995 in Orlando, FL, with administrative and technical support provided by the Naval Air Warfare Center, Training Systems Division. There were 136 participants from all parts of the Navy Training Community. A separate report [Ref. (1)]² detailing the conduct and results of this Workshop has been issued by NSWC/CD.

4.2.1 Workshop Results

As described in Ref.(1), the study results were obtained at the Workshop in the following areas:

- a. A detailed assessment and voting of importance of the 15 Hypotheses and their associated information scenarios. These assessments are summarized in section 5.
- b. Identification of a number of technological and procedural issues which must be resolved for full exploitation of IETMs and related automated systems in Navy training. These issues are summarized in section 6.
- c. Forty-seven Candidate Projects of proposed IETM/training efforts from the Navy's system acquisition managers and training personnel, for Phase II consideration and possible incorporation into future OPNAV Program Objectives Memorandum submissions. These Candidate Projects are summarized in sections 7 and 8.

4.2.2 Overall Perspectives Resulting from Site Visits and Worksho

The study takes into account general information obtained during the site visits and Workshop, affecting the overall Navy training program in the following areas:

- a. The possible role of IETMs, integrated with other automated training and management systems in factory, Schoolhouse, and Fleet training;
- b. The extent to which these integrated actions can improve training and reduce risk in downsizing the Navy's training establishment.
- c. And, of particular significance, the interfaces and need for cooperation among various training functions and organizations involved in the generation and use of automated system-related Technical Information in all applications.

²Ref (1). Joseph J. Fuller, Eric L. Jorgensen, Samuel C. Rainey, and Theodore J. Post, *Summary of a Workshop on Potential Benefits to Navy Training Programs Resulting from Increased Use of Interactive Electronic Technical Manuals (IETMs)*, Orlando, Florida, 24-26 May 1995. NSWC CD TM-18-95/09 (Jun 1995).

4.3 SURVEY OF AIR FORCE APPLICATIONS OF IETMs TO TRAINING

U.S. Air Force policy regarding the acquisition of Technical Orders (Air Force term for Technical Manuals), including Interactive Electronic Technical Manuals, is centered at the U.S. Air Force Materiel Command (ESC/AV-23), Wright-Patterson Air Force Base, Ohio. The group is a part of the AF CALS office, which also manages the TMSS (Technical Manual Specifications and Standards) Standardization Area. In a discussion with this office, they report that they have not yet attempted to incorporate training requirements into IETM acquisition concepts, policy, or use.

Technical Orders (TOs) continue to function as textbooks for system training in the Air Force, as in the Navy. The functions of training enlisted technicians is centralized in the Air Education and Training Command (the recently renamed "Air Training Command"). This major dichotomy of responsibility (acquisition of TOs and using them for training) between two major divisions of the Air Force staff (AFMC and ATC) has not as yet been overcome to the extent that a detailed assessment of the integration of IETMs and automated system-oriented courseware can be carried out.

In fact, current Activity by personnel concerned with TOs in the Air Force is very largely occupied by two critical logistic considerations:

- a. Digitization of the USAF stock of 16,000,000 pages of Technical Orders, an action supported by OSD. This effort is being carried out under the direction of the AFMC TO staff by the Defense Printing Service (DPS). It involves scanning legacy Technical Orders, converting them into ASCII form through OCR, adding hypertext links and "Navigation" instructions, recording the Technical Information on CD-ROMs, and distributing the resulting TOs to the end users. The entire process has been scheduled to be accomplished in three years. DPS is carrying out this process with a combination of hardware and software called Automated Documentation Conversion Service (ADCS); the final form will be in PDF (Portable Document Format, developed by the Adobe Corporation).
- b. Attempting to restructure the approach to the acquisition of all Technical Orders in response to Air Force interpretation of the "Perry Memorandum" dealing with elimination of MILSPEC requirements. The newer procurement philosophy of maximum reliance on COTS/NDI components is still in the process of resolution.

Accordingly, little time has been available to the Air Force staff to consider some of the valuable IETM uses involving advanced training technology.

4.4 SURVEY OF ARMY APPLICATIONS OF IETMs TO TRAINING

U.S. Army policy for establishing IETM-acquisition policy and technical requirements is centered in the Logistics Support Activity (LOGSA), under the U.S. Army Materiel Command. LOGSA is located at Redstone Arsenal, Alabama.

Like the Air Force, Army TM-policy staffs have been more concerned with revising their TM-acquisition policy and with digitizing their stock of paper TMs (some 3,500,000 pages) than with developing a position on integration of IETMs and automated courseware.

The two-phase Army digitization schedule calls for distribution of the first PDF Technical Manuals on CD-ROM to the Second Armored Division by 24 August 1995. Host for "copies of record" of the new digitized TMs will be the JEDMICS system.

The Logistic Support Activity is also deeply involved in revising its overall Army TM-acquisition policy and requirements, based on a turn toward commercial products. They have prepared a draft Handbook, MIL-HBK-729A, for this purpose, which has been under review at the DOD level for some months.

However, the Army has been concerned also with changeover from digitized hyperlinked legacy Technical Manuals to IETM capability. They have convened a panel consisting of members from LOGSA, the Strategic Logistics Activity (SLA) of the Department of the Army, and PMTMDE (Project Manager, Test, Measurement, and Diagnostics Equipment) to prepare a "Strategic Plan" to propose action in this area for the next five to ten years. One part of this Army-wide plan will be to treat the applications of IETMs to training. (Another will be the applications to diagnostics.) An initial draft was scheduled for the end of July 1995.

5.0 IDENTIFICATION OF POTENTIAL BENEFITS TO TRAINING OF IETMS AND IETM-RELATED SYSTEMS

This section summarizes the results of the study concerning an overall assessment by the Training Community and by the study team as to the applicability and potential payoffs of a wide variety of possible uses of IETMs and IETM-related systems in Navy training.

5.1 ASSESSMENT CATEGORIES

The IETM Assessment Form, Table 3, was used as the primary method of evaluation of potential IETM applications and payoffs in 15 categories. The form was completed by 117 of the 136 Workshop participants. The following assessments were carried out for each of the 15 Hypotheses:

- a. Generally Support or Reject (section 1 of the Form).
- b. Potential for Significant Payoff (section 3 of the Form), rated from Low to High, using a scale of 1 to 5.
- c. Effectiveness (section 4 of the Form), based on an estimated percentage of improvement.

In addition, this Form provided space for proposed modification of the Hypothesis or MOE (section 2), and for general comments (section 5).

5.2 PARTICIPATION IN THE ASSESSMENT

Inputs were provided from essentially all segments of the Navy, and from representatives of the Marine Corps. Analysis of the assessment results, and of comments made by participants, has indicated that the reactions to the Hypotheses, and estimates as to their potential payoffs, were, in many cases, functions of:

- a. The Activity to which the Assessment pertained (e.g.: Systems Command in charge of preparing Technical Information; Schoolhouse training; Fleet training; Fleet user).
- b. The level of experience with, and understanding of, IETMs and other forms of automated training.
- c. The breadth of responsibility for training functions (ranging from CNET representatives to participants representing training requirements for a single system).

Nearly all participants incorporated amplifying comments (sections 2 and 5 of the Form) providing qualifications to the bare numerical estimates provided and reasoning for the choices made.

5.3 ANALYSIS OF POTENTIAL IETM BENEFITS TO VARIOUS ASPECTS OF NAVY TRAINING

Potential payoffs of the IETM for various training applications (the 15 Hypotheses) were analyzed in terms of their acceptability to various aspects of the Training Community, the likelihood of their providing a high payoff, and a quantitative estimate of this potential payoff.

5.3.1 *Support or Rejection of Hypotheses*

Table 5 shows the percentage of the participants who accepted each of the 15 individual Hypotheses.

Table 6 lists the five Hypotheses supported by more than 90 percent of the responding participants. Three of the 15 Hypotheses were not in general support by the Workshop participants. These are listed in Table 7.

5.3.2 *Potential for Significant Payoffs*

Table 8 shows the percentage of the participants who rated the Potential Payoffs of IETM uses represented by the individual Hypotheses as 3 or higher (on a scale of 1 to 5).

Note that comments made on the assessment form, and during the Workshop, indicated that the potential-payoffs assessments are to be interpreted as achievable if certain technological and procedural issues (see section 6) are resolved, and if the IETMs included are properly constructed to meet the requirements of the particular functions involved.

Table 9 lists the Hypotheses with the highest potential payoffs (rated 3 or above in section 3 of the assessment form) by 65 percent or more of the participants.

Several of the Hypotheses were assessed as likely to provide relatively little improvement in training. Table 10 lists the four Hypotheses for which more than 50 percent of the participants assessed the potential payoff as at 2 or less, on a scale of 1 to 5.

**Table 5. Acceptance or Rejection of Individual Hypotheses
By Workshop Participants**

Hypothesis No.	Percent Supporting
1	92
2	92
3	87
4	84
5	85
6	76
7	42
8	68
9	73
10	93
11	46
12	79
13	54
14	91
15	92

Table 6. List of Hypotheses Supported by More Than 90 Percent of the Responding Participants

Hypothesis	Percent Supporting
10. Reduction in Physical Size of Areas Required for TM Storage	93
11. Reduction in Procedure Training in Schoolhouse	92
2. Reduction in Time Needed for Students to Achieve a Specified Proficiency	92
15. Improvement in Interactive Courseware by Use of IETMs	92
14. Improvement in Distance Learning	91

Table 7. List of Hypotheses Receiving Less Than 55 Percent Support by Workshop Participants

Hypothesis	Percent Supporting
7. Achieving a More Efficient Technician Training Sequence	42
11. Shifting of Schoolhouse Certification Training to the Fleet	46
13. Conversion of System-Description to Task-Oriented Training in Schoolhouse	54

**Table 8. Percent of Participants Rating Potential Payoffs
as 3 or Higher on a Scale of 1 to 5**

Hypothesis No.	Percent of Participants Rating Potential Payoff as 3 or Higher
1	61
2	76
3	72
4	54
5	56
6	65
7	36
8	47
9	50
10	80
11	32
12	60
13	45
14	65
15	77

**Table 9. List of Hypotheses Rated as Having
the Highest Potential Payoffs
(Rated by 65 Percent of the Participants at 3 or Above)**

Hypothesis	Percent Rating at 3 or More
10. Reduction in Physical Size of Areas Required for TM Storage	80
15. Reduction in Cost of Preparing ICW by Use of IETMs	77
2. Time Needed for Students to Achieve a Specified Proficiency	76
3. Development and Life-Cycle Support for IETM-Based Training Information	72
6. Use of IETMs to Provide Virtual Environment (VE) Training Support Equipment Instead of Conventional Training Aids	65
14. Improvement in Distance Learning	65

**Table 10. List of Hypotheses for Which
More Than 50 Percent of the Workshop Participants
Rated the Potential Payoff at 2 or Less**

Hypothesis	Percent Rating at 2 or Less
11. Reduction in Schoolhouse Certification Training	68
7. More Efficient Sequencing of Enlisted Technicians	64
13. Conversion of System-Description to Task-Oriented Training in Schoolhouse	55
8. Reduction of Risk in Combining Ratings	53

6.0 TECHNOLOGICAL AND PROCEDURAL ISSUES

6.1 IDENTIFICATION OF ISSUES

During the site visits and discussions at the Workshop, a number of major issues were identified. It was the consensus of the representatives of the Training Community that solutions must be found for these procedural and technological problems to permit the most effective use of IETMs in Navy training (as well as the most effective use of other advanced technology capabilities now becoming available).

Workshop participants voted that nine of these issues should be considered major issues; other issues raised were considered important but of lesser importance. Table 11 lists these nine issues.

Although not considered part of the scope of Phase I of this study, further analysis is clearly important in planning the future course of the Navy's training establishment. [The Workshop did not attempt to resolve, or to provide solutions to, these issues.] A somewhat more elaborate discussion of these issues was included in the Workshop report, Ref. (1).

6.2 INTERFACES

The initial issue raised during the site visits and at the Workshop concerned the definitions of terms and the interfaces linking various aspects of the use of IETMs and other forms of Technical Information automation and electronic presentation. Figure 1 illustrates this interaction. The subject of the Workshop and of Phase I of this study is largely the potential represented by the confluence of the three systems shown on the Figure: the Curriculum Support System, the Instructional Delivery System, and the Information Support System. At the Workshop, a statement of this interface issue was considered to be a part of Issue 7.

**Table 11. Nine Major Issues Requiring Solution To Assure
Most Effective Use of IETMs in Navy Training**

(Not listed in order of priority)

1. Establishment of a Schoolhouse Infrastructure Capable of Handling IETMs
2. Establishment of Life-Cycle Support for IETMs
3. Establishment of a Fleet Training Infrastructure
4. Assurance of Continuity Among Learning Environments
5. Reduction of Undue Training Requirements on Shipboard/Fleet
6. Establishment of Funding for IETM/Training Material/ICW Acquisition and Upgrade
7. Need for Navy Policy and Infrastructure for IETMs (including Interfaces)
8. Facilitate Federal Information Processing (FIP) Approvals
9. Establishment of "Distributed Database/Architecture"

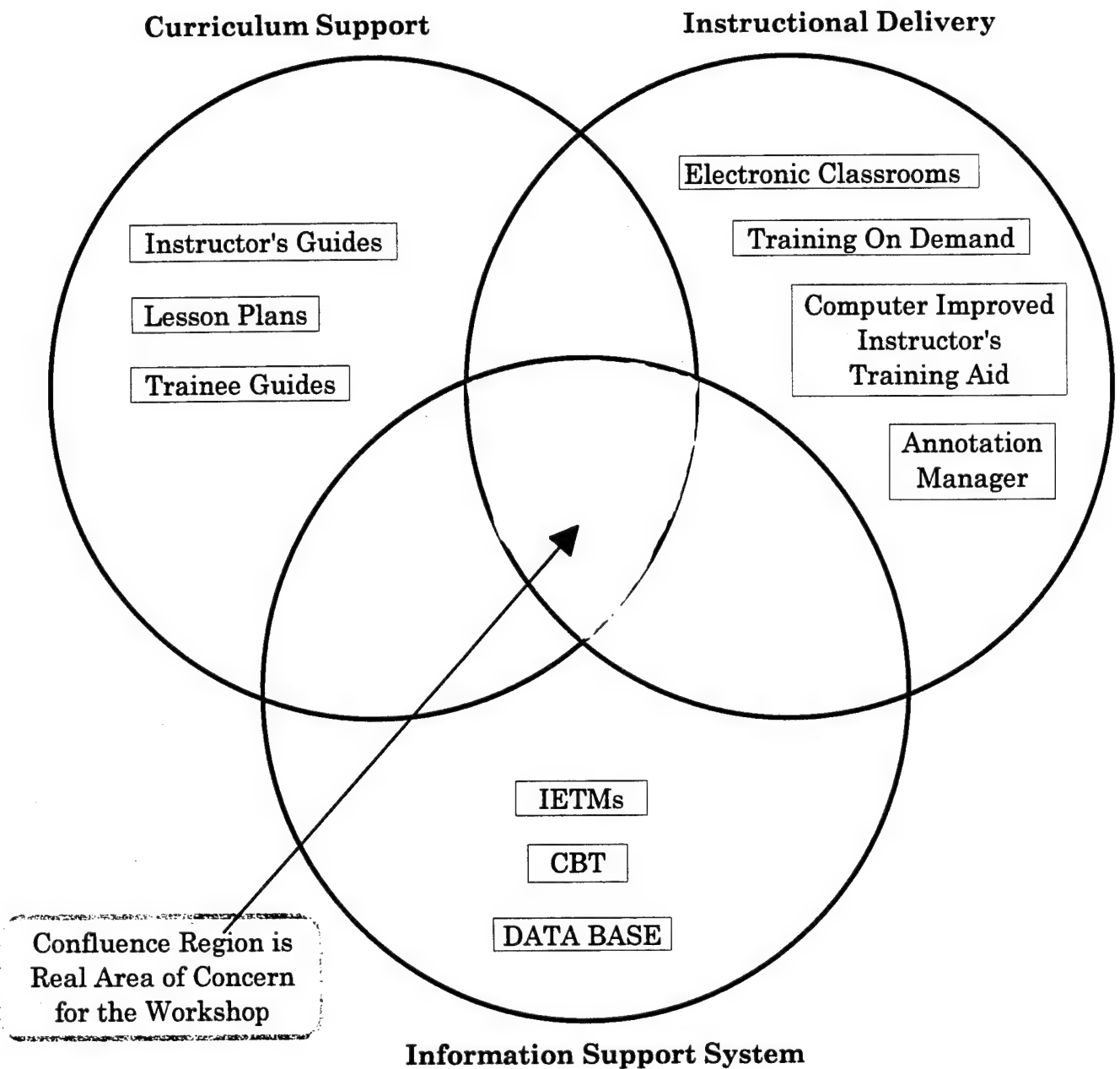


Figure 1. Confluence of Classroom Support System, Instructional Delivery System, and Information Support System

7.0 IDENTIFICATION OF CANDIDATE PROJECTS

7.1 IDENTIFICATION OF HIGH-PAYOFF TRAINING OPPORTUNITIES INVOLVING IETM USE

As noted in the study tasking (par. 2.2.3), a requirement of Phase I has been to identify proposed efforts involving the integration of IETM use in Schoolhouse or Fleet training programs for more detailed analysis in Phase II, and for possible incorporation for funding in OPNAV and N71 Program Objective Memorandum submissions.

Obtaining candidate submissions of such proposed efforts from various Activities of the Training Community, and from ongoing system-development Activities, was a major purpose of the study. A total of 47 submissions of Candidate Projects were received by the study team during and after the Workshop.

7.2 FORMAT FOR CANDIDATE SUBMISSIONS

NSWC/CD provided to each Workshop participant a four-page form [reproduced in Ref. (1)] to serve as the basis for descriptions of such candidate submissions. Table 12 lists the types of information requested.

7.3 SELECTION CRITERIA

A set of eight "Selection Criteria" was developed and forwarded as pre-conference material to Workshop participants, indicating the types of candidate submissions that would be of interest in the context of this study. (The Candidate Submissions form requested an evaluation of the proposed effort in terms of each of these criteria.) The eight Selection Criteria are listed in Table 13.

Based on site visits, discussions at the Workshop, and analysis of submitted candidate writeups, a number of additional Selection Criteria have been established. These are shown in Table 14.

7.4 CLASSIFICATION OF CANDIDATE PROJECTS

A total of 47 Candidate Projects were developed during Phase I for further consideration. Table 15 summarizes the number of Candidate Projects by warfare area. A breakdown of the Candidate Projects by the Breakout Group at the Workshop was as follows:

New Systems	18
Legacy Systems	21
Schoolhouse	8

Table 12. Information Requested for Candidate Submissions

- | | |
|------|---|
| I. | Short Title |
| II. | Project Description |
| III. | Selection Criteria Met |
| IV. | Candidate Program Relation to Hypotheses
Primary
Secondary |
| V. | Payoff Expected |
| VI. | Investment Required
Initial
Life Cycle |
| VII. | Support System Information (Preferences, Comments, Planning Data) |

**Table 13. Initial Selection Criteria Established for
Choice of Candidate Efforts for Future Consideration**

1. At least one Candidate from each of the following communities: Air, Surface, and Submarine. A USMC and a Joint program will be considered if sufficient information exists and a good Candidate exists.
2. The states of development (new systems, major upgrades, or logistics) must afford capturing savings within a three-year window of opportunity; e.g., 3-5 years after initiation of funding.
3. The Candidate must possess characteristics consistent with substantial cost-saving potential; e.g., personnel throughput, importance to longer-range Navy objectives, and numbers of systems to be acquired.
4. Proposed solutions must be portable to other applications and interoperable with other training technologies and training management systems.
5. Candidates must include existing training plans for operations and maintenance.
6. Candidates must have actions underway, or plans to acquire IETMs, or an interest in IETMs.
7. The acquisition manager and staff must have an interest in training automation and a willingness to participate in the study; e.g., staff participation in Phase II study.
8. Training programs must have data available; e.g., facts and figures relating to current method of training, especially use of Technical Manuals.

**Table 14. Additional Selection Criteria Established for
Candidate Systems**

9. Importance or significance of training implications of proposed effort
10. Optimal size of effort (neither too small nor too large)
11. Inclusion of innovative technology or training approaches
12. Degree of interaction with other automated training or information systems or technologies
13. Relevance to those Hypotheses considered by Workshop participants to offer the greatest potential payoff
14. The extent to which the Candidate effort consists of a trend setter; e.g., offering a true database integration for all training and courseware functions, and IETMs
15. Breadth or balance across various Navy Training Community interfaces

**Table 15. Breakdown of Candidate Projects
by Warfare Area**

WARFARE AREA	No. of Projects
Surface	19
Submarine.....	4
SPAWAR	4
Air.....	7
Strategic Systems	6
CNET	3
Intermediate/Depot Level Maintenance	2
Marine Corps	2

8.0 SUMMARY AND ANALYSIS OF CANDIDATE PROJECTS SUBMITTED BY TRAINING COMMUNITY

8.1 SUMMARY OF CANDIDATE PROJECTS

Each of the 47 Candidate Projects representing proposed Navy training efforts, which were prepared as Candidates for further evaluation in Phase II of the study, is described in a short summary on the following pages. Table 16 lists the categories of Information provided.

**Table 16. Information Categories Listed in Presentations
of 47 Candidate Project Submissions**

TYPE OF INFORMATION	
Candidate Project Title:	As submitted
Revised Title:	As required for clarification of objective
Point of Contact:	
Organization Submitting:	
Summary of Project:	Of proposed action, as submitted
Characteristics of Project:	Descriptive factors, primarily from the Candidate Project writeup
Comments:	Evaluative notes, prepared by the study team, relating to the proposed effort in the context of the present study

Note that, in a number of cases, information presented is based on discussions held by the study team with the submitter, and, in some cases, on supporting material provided after the initial submission.

CP-1

Candidate Project: Joint Maritime Command Information System (JMCIS)

Revised Title: Develop IETM (Planned but Unfunded) for JMCIS, with links to CBT/ICW

POC: Barbara Ellis

Organization SPAWAR 10-14K

Summary:

SPAWAR currently plans to convert the three-volume systems manual the for Joint Maritime Command Information System (JMCIS) into an IETM. It is also proposed to extend that IETM to include or interface with the training system. The effort would establish CBT/CBI requirements and develop pilot implementation.

Characteristics:

- JMCIS is a new program evolving from the Naval Tactical Command System - Afloat (NTCS-A). It incorporates approximately 70 tactical and non-tactical systems onboard all ships and submarines and at various shore sites with SATCOM and LAN connectivity. At least one of the new systems is developing a Class 2/3 IETM.
- Approximately 1,200 legacy-system TMs are in raster (ATIS) format and in paper. These are currently being collected and converted for both ATIS and non-ATIS applications using Portable Document File (Adobe Acrobat/Hercules) processes.
- Ideally, the plan will allow links from the system IETM to JMCIS subsystem manuals and to CBT/ICW. The contemplated use of IETM/training technologies has potential for a significant impact on Schoolhouse training, due to the size of the overall system, number of subsystems, and the population of users.
- Only the system manual is in the IETM-conversion plan.
- AIM is in use at Schoolhouse but how to use it with the IETM has not been determined at this time.

Comments:

CP-1 is an excellent application of a Government-developed system-level IETM which will serve as a master index and first-level troubleshooting guide for some 1200 individual component manuals which will be in various stages of electronic form. The training applications of such a master IETM have not yet been developed. This project needs some conceptual development before a realistic cost-benefit analysis can be carried out.

CP-2

Candidate Project: AN/SPQ-12(V) Radar Data Distribution System (RADDS)

Revised Title: Display Systems for AN/SPQ-12(V) Radar Data Distribution System (RADDS)
IETM

POC: Vicki L. Watson, 804-433-8247

Organization: NAVSURFWARCEN DET, NORFOLK CODE 60

Summary:

AN/SPQ-12 has an IETM in process; however, the program needs resources for acquisition of user display systems in Schoolhouses and all ships to achieve full benefits.

Characteristics:

- A highly visible program, RADDS is taught at all radar schools. High throughput of students. Development of NTP in progress.
- RADDS employs a built-in Target Generator/Trainer (TG/T) emulator for scenario simulation to facilitate effective training. This unit is designed to meet all Battle Force Technical Training (BFTT) specifications.
- Submitter claims that Level 4 content-oriented IETM, when used with ICW, will:
 - Reduce Schoolhouse procedure-training time and reduce academic attrition for specific portions of the course.
 - Reduce logistics time for maintenance.
 - Increase first-tour productivity.
 - Reduce storage space.
 - Reduce Schoolhouse course duration.
 - Integrate 3M, supply, FMS, Technical Information.

Comments:

- For CP-2, the submitter claims that the only investment will be computer hardware and software on all ships and in Schoolhouse (including maintenance and upgrades); however, additional information will be needed to establish the extent to which IETM and ICW will work together.
- There appears to be real potential for benefit here; however the reference to only a "partial IETM" in development at this time and the lack of reference to integrating the IETM with the ICW may indicate that additional development would be needed to build a model product.

CP-3

Candidate Project: IETM/ATRR (Automated Tracking, Reporting, and Requisitioning) Module

Revised Title: Integration (and Testing) of an Automated Tracking, Reporting, and Requisitioning (ATRR) Module into an Existing SSPO IETM

POC: George Williams, 301-231-2281

Organization: VITRO/SSPO

Summary:

Demonstrate that an automated maintenance-action tracking, reporting, and requisitions module embedded in an IETM would:

- Improve maintenance reporting (errors and omissions);
- Improve maintenance productivity (time to repair); and
- Reduce training requirements (subjective measure).

Characteristics:

- The Project would add a module containing the required functions to an existing demonstration IETM. The enhanced IETM would be used as a test IETM to measure comparative values experienced in test conditions arranged with the TRIDENT training facility in King's Bay.

Expected Payoffs:

- Reduced errors and omissions by 20 percent.
- Reduced total time to repair (including reports and requisitions) by 30 percent.
- Reduced time to prepare maintenance reports and requisitions (associated with maintenance actions) by 20 percent.
- Reduced training requirements (subjective).

Comments:

- CP-3 should be a low-risk/high-payoff effort because an IETM is inherently capable of providing a detailed record of maintenance actions and events that can be accessed for past-action review and analysis. This capability, with the use of coupling to a reports/requisitions-preparation module, would make it easy to accumulate a database of maintenance history for the development of improved procedures, improved training, and/or expert maintenance systems.
- Implementation cost is quite low until expert-maintenance capability is included.
- This enhanced IETM could be of great interest to the logistics community and the FBM maintainers; however, its immediate benefit to the Training Community is less clear.

CP-4

Candidate Project: AN/USQ-82, Data Multiplex System (DMS), DDG-51 Class

Revised Title: Integrated Training Modules for Incorporation into AN/USQ-82 [Data Multiplex System (DMS)] IETMs for DDG-51 Class

POC: V. P. Paschke, Jr.

Organization: NAVSEA 03K123

Summary:

The DMS and its follow-on, the Fiber Optic DMS (FODMS), have IETM developments underway (based on converting legacy data). This Project proposes to add training components to IETMs for the DMS and FODMS for the DDG-51 ships. It also proposes to integrate performance monitoring/fault localization capability into the integrated IETM/training product.

Background:

- DMS Technical Manuals are currently Functionally Oriented Maintenance Manuals (FOMMs), an older paper product which is costly to print, and expensive to maintain. In developing an updated DMS, FODMS, the project office has recognized these shortcomings, and has opted for an IETM at the outset. It has also included an integrated performance monitoring/fault localization (PM/FL) scheme built into the IETM.
- Recently the DMS Program Office has decided to replace the current paper TMs with IETMs, profiting from the FODMS IETM developments to date. However, the DMS IETMs are not integrated with a performance monitoring/fault localization (PM/FL) scheme like the FODMS IETM, nor have training capabilities have been integrated into the system.

Characteristics:

- Existing DMS TMs are "modular" in nature. A training module or PM/FL module could be added to the DMS IETM development if funds were available.
- The DMS IETM conversion had just been put under contract. The nature of the legacy FOMM manuals is such that substantial reengineering of the information is required in a conversion. Experience from this information reengineering could greatly facilitate the creation of integrated training modules.
- DMS users represent a large, centralized, and highly visible community at Great Lakes, ISEA, SPCC, and the Depots.
- The IC Rating is scheduled to be eliminated and the impact of this action in DMS training is significant.

Claimed Savings:

- Significant reductions in DMS Technical Information life-cycle costs.
- Resolves current significant DMS training issues.
- Enhances utilization of training resources by introducing efficiencies in the availability of reference texts and ease of downloading capability for distance training.
- Facilitates paperless ships for the DDG-51 class.
- Facilitates merger of IC rate into ET/EM rates.

Comments:

CP-4 appears to be one of the better proposals for developing an integrated IETM/ICW product. Coordination of some kind with PMS 400/AEGIS Training Center is recommended. It is recommended that this Project be planned to make maximum use of the information-reengineering experience to build a high-quality product which could be a trend setter. The Program Office is understandably conservative in their goals for their proposal; however, this Project might be a candidate to effectively utilize emerging technology and build a model integrated product involving IETM, ICW, and condition-based-monitoring. An excellent proposal meeting all criteria.

CP-5

Candidate Project: Life Cycle Multimedia Training

Revised Title: Study to Identify Computer Resources Needed for Multimedia/Training
Implementation On-Board Non-AEGIS Ships

POC: Dolly G. Hoffman

Organization: NAVSEA 91WA

Summary:

- Survey the Navy's non-AEGIS surface ships to determine computer resources available or needed, and the cost of upgrades required, for implementation of partial or full multimedia training.
- Develop requirements for IETM and multimedia training that will be required. Knowledgeable trainers, not engineers, are needed to develop the required templates.
- Based on results of the above studies, develop performance requirements for new Tycom/Syscom standardized computer buys and upgrades. This survey and definition of requirements would increase the ease and speed of introduction of multimedia training into non-AEGIS surface ships.

Characteristics:

- Problem: NAVSEA needs to know what computer resources are available to realize improvements in two years after FY 97; if deficiencies exist, resources to acquire and maintain the needed equipment are required.
- For example, inefficient training sites and ships exist which are teaching with multimedia courseware using one or two semi-obsolete computers for 20 or 30 students.

Investment

- Possibly \$1M for one year.

Comments:

CP-5 is a "requirements" study emphasizing computer resources and templates for IETMs and training. It represents a useful effort for NAVSEA; however it is not the type of project envisioned in this study. It does not primarily address how IETMs and multimedia will interact, nor identify mechanisms regarding saving training resources.

CP-6

Candidate Project: IETM/ICW/ECR for Submarine Machinist Mate Pipeline

Revised Title: Develop an IETM/ICW Program in the Electronic Classroom (ECR) for the Submarine Machinist Mate Training Pipeline.

POC: Carl Haines, 703-602-7005 x537

Organization: NAVSEA 92L1/92L43

Summary:

Integrate existing resources [digital library products (Technical Manuals already on CD-ROM), curricula (prepared by AIM), and Interactive Courseware (already in place)] to implement a total IETM/ICW program in the Electronic Classroom for the submarine Machinist Mate training pipeline.

Characteristics:

- The Project is well underway, using Class 1 and Class 2 ETMs; it would derive significant benefit and cost avoidance from conversion to Class 3 IETMs, a major part of the Proposal.
- The technology and products developed would be directly transportable to the Surface and Air communities for general "machinist" type courses.
- The effort would support the OPNAV/PERS/CNET Torpedoman (TM) and Machinist Mate (MM) rating merger (occurring within the next two years) and would eliminate training modules which currently support each rating, leading to reduction in Navy instructor, infrastructure and training curricula life-cycle costs. It would also provide a capability to detail Machinist Mates across all submarine platforms.
- The Project would support all 688/726 class submarines currently in existence, a high payoff.
- All supporting curricula for the system have either been prepared using AIM, or are in the process of being converted to AIM-based courseware. The Technical Manual information for this Program is either already in digital media or is being processed to facilitate the conversion to an IETM.
- IETM technology will provide substantial cost avoidance through greatly reduced Technical Manual and curriculum print, distribution, storage, and life-cycle/maintenance costs (distribution is to 350 Activities, including 88 platforms and various shore facilities).
- A team of Government employees exists with expertise in all areas of Technical Manual and curriculum development.

Comments:

CP-6 is one of the best Candidate Projects that is not tied to a specific weapon system. It is an excellent candidate for further consideration. Most of the information appears to be available for developing a full proposal.

CP-7

Candidate Project: Regional Maintenance Training Support

Revised Title: Integrate an Existing IETM with ICW for an Integrated Work Force in Regional Repair Centers

POC: CAPT Rich Funke/Tony Walker, DSR

Organization: CNO N431H-T

Summary:

CP-7 recommends introducing an existing IETM, possibly for the LM-2500 Turbine or the Issotta Francini diesel engine, into a Regional Repair Center manned by an integrated work force, to assess capability of IETM use for relieving problems associated with consolidation of training and maintenance functions. The result would allow immediate collection of data (with minimum investment) relating to many of the fundamental changes being brought about by the Regional Maintenance Center concept and associated initiatives.

Characteristics:

- The proposed Regional Repair Centers would cross technical lines; e.g., avionics/electronics repair. This proposal could be demonstrated at either a Naval Aviation Depot or a Naval Shipyard.
- The IETM would support a common training process for the DOD civilian and military work forces; thus, the proposed effort has potential for very significant savings.
- IETMs provide a key element to the standardization of the repair/maintenance qualification and training processes. The products could easily be exported to the Fleet.

Expected Payoffs:

- Development of a single competency standard for like work throughout the Navy industrial community.
- Elimination of maintenance-training redundancies.
- Reduction of redundant program-management costs.
- Reduction of training time for civilian and military personnel.

Comments:

- As the Navy consolidates its Depots and combines the training of civilians and military into one training program, there is a tremendous requirement for a new look at training in the Depots. This need is reinforced by the exodus of retiring experienced personnel (taking buyouts), which mandates a restart of the apprentice program. New training costs are certain. Integrated IETM/ICW products, under whatever name they might have in the Depots, could substantially reduce these costs.
- CP-7 is highly recommended for further study. The overall effort would probably require development of new Depot concepts and definition of new associated job-aid/training products.
- The study should link the business case to the decommissioning of tenders and should include an evaluation of how the improved OJT would increase self sustainability at sea.

CP-8

Candidate Project: Expert System (ES) IETM

Revised Title: Expert System (ES) IETM for FBM Submarine ESGN

POC: Deborah Stephenson, SSP; and Richard Banuelos, SSP-SP24/Rockwell International

Organization: SSP-SP24/Rockwell International

Summary:

Develop an Expert System (ES) for the Electrostatically-Supported Gyro Navigator (ESGN) onboard FBM submarines. A newly-developed ESGN IETM for FY 98 (10/97) delivery would be coordinated with the proposed ES and with training in the Classroom with AIM-based curricula. The proposal is based on SP-11's goal of a paperless classroom (a fully funded program that upgrades the Navigation Subsystem on Trident II SSBNs). Associated IETMs will be Class 4, complying with MIL-97268, MIL-87269, and MIL -87270.

Characteristics:

- The ES would consist of several Virtual Machine Environment (VME) modules resident in the ESGN Electronic Console (EEC).
- The ES module would recommend the appropriate troubleshooting/diagnostic path to the operator. Additionally, the ES would interface with the logistics support system (i.e., electronic parts ordering, trouble and failure reporting, and job planning). Access to the ES would be provided by an ethernet-connected laptop computer. The above configuration would be provided to the Schoolhouse for training in a simulated tactical environment.
- Management is completely supportive and has required the participation of the SSP training community throughout development and implementation of the IETM.
- The ES would reduce the physical size of area for TM storage onboard submarines and practically eliminate it in the Schoolhouse. Storage for the laptop computer would be required.

Reasons why this program is suitable for follow-on analysis as a testbed for using IETMs, VE, and ICW in the Schoolhouse include:

- Improvements would be quantifiable (based on long history and available statistics reflecting the use of conventional training methods over the last 20 years). Some IETMs and ICW will cover new equipment and some existing equipment (converting legacy data). Any change in the training experience due to the use of IETMs and ICW would be readily apparent and measurable.
- No infrastructure investment. SP-11 will fund the development of the paperless classroom. Only the additional functionality that may be of interest to N7/N81, but not included in the current SP-11 design, would require additional funding.
- Common program manager. Data acquisition (TMs), training, and TM maintenance are handled by a single program manager and are performed on a life-cycle basis by the same prime contractors.
- Platform compatibility. Because there is a single program manager, the compatibility of the tactical IETM/ICW/VE display device and the paperless classroom is assured.
- Contractors are already developing training curricula using AIM and have produced IETMs and ICW.

Comments:

CP-8 is one of the best Candidate Projects, and one of the few that include leading-edge technology. It is highly recommended for further study.

CP-9

Candidate Project: Submarine Combat Weapon Systems IETM/ICW in the Electronic Classroom (ECR)

Revised Title: IETM/ICW for the Submarine Combat Weapon Systems Electronic Classroom (ECR)

POC: Carl Haines/Jim Slantis

Organization: NAVSEA 92L1/92L43

Summary:

- Define and implement for the Submarine Combat Weapon Systems (Combat Control System MK 2 and AN/BSY-1 Acoustics) an integrated IETM and ICW in an ECR. The integration would use a retrieval process which facilitates the use of a variety of Technical Information and improves the integration of Technical Information with pipeline curricula and other data to reduce training time in an ECR environment.
- An additional objective concerns the merging of five existing Submarine Combat Control System (CCS) training pipelines into one, leading to reduction in Navy instructor and infrastructure requirements and training-curricula life-cycle costs. It would also provide a capability to detail CCS technicians across all existing submarine platforms.

Characteristics:

- Curricula have been prepared which either are using AIM or are in the process of being converted to AIM-based courseware. TMs are either already in digital form or are being processed to facilitate conversion to an IETM.
- IETMs will provide substantial cost avoidance through greatly reduced TM and curricula print, distribution, storage, and life-cycle/maintenance costs (distribution is approximately 150 Activities, including 88 platforms and various shore facilities).
- A team of Government employees with expertise in all areas of TM and curricula development has been assembled.
- The NAVSEA Technical Information life-cycle management and the training-systems support manager support and actively contribute to this Project.
- Substantive statements of payoffs and investments would make a follow-on study easier.

Comments:

CP-9 is an excellent proposal for assessing integration of existing TI legacy resources and integrating them under the umbrella of the Electronic Classroom. It would be a great facilitator for combining the various CCS training pipelines into a single pipeline. It appears that much of this effort is funded. Additional funding appears to be needed to support and possibly accelerate this initiative.

CP-10

Candidate Project: RAM Technical Manual Documentation

Revised Title: Convert Paper TMs to IETMs for the Rolling Airframe Missile (RAM)

POC: Eddie Scott

Organization: NSWC PHD

Summary:

The RAM project has a current requirement to procure 20 copies of RAM TMs to support scheduled classroom training. A future problem is that the RAM program is developing a new system configuration requiring a double set of TMs (one for old, one for new). The vision is a RAM IETM that will support technical and training documentation in one package.

Characteristics:

- The current TM is paper with TI captured digitally using WordPerfect and AUTOCAD applications. It has not been SGML tagged. The IETM would be developed in a Class 3 linear structure to take advantage of the existing legacy data already in digital format.
- The first IETM phase will use the Hughes AIMS authoring software. The second phase would be to integrate training.
- Savings include cost avoidance, rapid access to information, current and accurate information, and portability.

Comments:

- CP-10 contains little information regarding the IETM's interface/interaction with training.
- This Project appears to represent a sound case for IETM development with significant incidental training benefits.

CP-11

Candidate Project: Support Structure for Gas Turbine IETM

Revised Title: Develop Support Structure for the LM-2500 Gas Turbine IETM Now in Use at Great Lakes

POC: Harry Felsen/SEA04TD, Bob Calogero/SEA04MP

CAPT Greg Maxwell/SSC and Sandra Drummer/CNET

Organization: NAVSEA 04 / SSC / CNET

Summary:

The current implementation of IETMs for the LM-2500 in the gas turbine C-Schools at SSC Great Lakes has moved ahead of the support structures required for long-term support of both the curriculum and the Technical Information. Currently, neither the curriculum nor the Technical Manuals (TMs) can be updated digitally. This Project proposes to build up the support structure that was not addressed in the initial rapid creation and deployment of this IETM.

Characteristics:

- Although some progress is being made (AIM for Windows, Technical Information Management System, etc.), the support structure to maintain the Gas Turbine System (GTS) IETM is largely missing, and the Schoolhouse cannot obtain digitized updates to its curriculum and Technical Information (TI), upon which it is dependent. Trying to keep the project afloat using local Schoolhouse effort prevents any realistic assessment of how the entire IETM process generates savings or costs in relation to training and other functions.
- CNET, SSC Great Lakes, and NAVSEA all recognize a strong need for creation of this support system if the GTS IETM is to be maintained. The Electronic Classroom (ECR) and IETM are complete and online, but support hardware is needed. The cost of updating the current system manually or allowing it to fall out of date are both very large.
- Implementation of additional IETMs without a capable support system and philosophy in place increases the danger of a program failing and requiring a return to paper courseware.

Comments:

Because of the attention the GTS IETM has received and the substantial claims of success, several independent evaluations of the effectiveness of CP-11 are currently underway. It is recommended that the results of these evaluations be examined before recommending this effort for further consideration. Little additional study is needed for the proposal itself. The submitters have most of the information in hand and it is well put together.

Candidate Project: Joint Simulation System (JSIMS)

Revised Title: IETMs and CBT for JSIMS

POC: William Clydesdale

Organization: SPAWAR 312

Summary:

JSIMS is a new program from which training simulations for USN/USAF/USA will evolve. It is a high-level open architecture effort which the DOD Modeling and Simulation Office (DMSO) supports. Utilization of an IETM and computer-based training is a recommendation which has been provided to the Operational Requirements Document (ORD). It has a POM '98 focus.

Characteristics:

The goal of JSIMS is to be a next-generation, state-of-the-art, Joint training simulator which will increase efficiency in training through distributed nodes and which will save overall training funding through the use of modern simulation. IETM and ICW would complement JSIMS operator and maintainer training.

Investment:

- | | | |
|---|---|----------|
| • FY 98 IETM Class 5 enhancements (technology) | : | \$200K |
| • Develop IETM/ICW plan | : | \$200K |
| • FY 99 Commence joint IETM/ICW development | : | \$500K |
| • FY 00 Complete development and beta test of IETM/ICW | : | \$1,000K |
| • All work in parallel with JSIMS modeling and simulation | : | \$1,900K |

Comments:

- Additional information is needed on:
 - How IETM and ICW would interact with each other, and
 - How IETM and ICW would interact with JSIMS.
- CP-12 may have potential as a Joint Services project; JSIMS would have high visibility, perhaps with strong Virtual Environment implications.

CP-13

Candidate Project: COBLU (Cooperative Outboard Logistics Upgrade)

Revised Title: Generation of IETM/ICW for COBLU

POC: LCDR Mike Makfinsky

Organization: SPAWAR PMW 178

Summary:

- COBLU updates a critical warfare information system on DDG-963 class ships and on UK Royal Navy destroyers.
- Each of the scheduled, three-phase efforts lends itself to incorporating state-of-the-art training technology such as IETM/ICW development, ICW produced by AIM courseware produced by a Technical Information Management System (TIMS), as well as IETM/3M documentation integration. SPAWAR plans to use the IETM as an on-line source for interactive courseware and maintenance, logistics support, and procedural training. Production of courseware by AIM and TIMS is mandatory.

Characteristics:

- COBLU is taught at the NTTC Corry Station Schoolhouse, Pensacola, at the Cryptologic Training Department Tactical Shipboard Systems C-School. Source ratings are cryptologic technicians, collection (CTR). The classroom uses a full-up combat system (TAC-3 based) for operator training and a second full-up combat system for maintenance training. IETMs could reduce the training use of both.
- IETMs are planned for Phase III (1998-2002) of the program, but the program would benefit from IETM introduction at the earliest opportunity (however, there is insufficient funding at this time). COBLU is scheduled to be integrated with Battle Force Tactical Trainer (BFTT) by 1998.
- This is a joint program with the United Kingdom; increase in efficiency through optimized training will also benefit our partners.
- This effort could serve to investigate creation of a "total-system support database" which would integrate engineering, Technical Information, ILS information (maintenance and supply), and interactive training information (on-line operator and maintainer performance support, as well as formal Schoolhouse multimedia ICW).

Comments:

CP-13 appears to be an excellent project to manage the evolution of support products for legacy systems. It is one that addresses both the operator and the system maintainer. There is a potential to reduce use of Technical Training Equipment (TTE). The concept is to acquire a single database to support engineering, IETMs, training, and logistics; and to have the trainer at Corry Station integrate it into a user product. The Program Manager will provide the hardware and integrating software to Corry Station, but will rely on the trainers and not on the program office to oversee the integration.

CP-14

Candidate Project: Combat Direction Finding (CDF) (ADAS Upgrade)

Revised Title: Develop and Integrate IETM/ICW Using AIM for the CDF (ADAS Upgrade)

POC: LCDR Mike Makfinsky

Organization: SPAWAR PMW 178

Summary:

- IETMs for the CDF are planned but currently unfunded. Once funded, they would have the potential to reduce use of two, full-up combat-system TTEs (TAC-3). The plan is to use the IETM as an on-line source for interactive courseware, and for maintenance and logistics-support procedural training. Courseware preparation with AIM and the Technical Information Management System is mandatory.
- The Project could be used to investigate creation of a "total system-support database" which would integrate engineering, Technical Information for logistics support (maintenance and supply), and interactive training information (on-line operator and maintainer performance support, and formal Schoolhouse multimedia ICW).

Characteristics:

- The CDF system provides critical information-warfare sensor capability aboard AEGIS destroyers and large-deck amphibious ships. As such, it could be managed as part of the paperless ship concept planned for these newer ships.
- CDF is taught at the NTTC Corry Station Cryptologic Training Department Tactical Shipboard Systems C-School. The Source rating is Cryptologic Technician, Collection (CTR). The classroom is located within a Sensitive Compartmented Information Facility (SCIF).
- CDF is scheduled to be integrated with BFTT about 1999.

Investment:

Estimates of initial and life-cycle investment costs require further input from the program manager and would be appropriate for a FY 98 or later start.

Comments:

CP-14 appears to be similar to CP-13 but involves a new system rather than a legacy system, and appears to have less cost-avoidance potential. It might be possible to include this Project as a planned follow-on from CP-13, or integrate it with the BFTT proposal CP-37, which is also a SPAWAR PMW-178 effort.

CP-15

Candidate Project: Develop Virtual Environment (VE) to Eliminate Need for Tactical Units in Training Facilities

Revised Title: Develop IETMs with a VE (Virtual Environment) Capability to Eliminate Need for Tactical Units in Trident Training Facilities

POC: D. Stephenson / J. Himes **Organization:** SP-24/SP-11

Summary:

- Two Trident operations and maintenance training facilities (Bangor and King's Bay) provide hands-on training using tactical units. The cost of this equipment is in the millions of dollars. As part of an upgrade program, some of the tactical equipment will be replaced. This new equipment is the basis for this Project.
- By using an IETM supplemented with VE technology to replace the tactical unit in the training facility, training costs would be reduced and some training could be moved out of the school and onto the submarine. After successfully proving the concept, all tactical equipment in the Schoolhouse could be replaced by VE to eliminate the need for the tactical units altogether. It is this last step that would provide the greatest advantages: (1) portability of training which would be no longer tied to the tactical hardware; (2) elimination of the need to build or support a special training facility; and (3) reduction in Schoolhouse training time.

Characteristics:

- Electronic Classroom development is planned and funded for FY 96/97. The contractor is currently using AIM for creating courseware, and IETMs are planned (other IETMs already exist).
- An Electronic Classroom will be developed; GOTS hardware and software will be used.
- Training plans call for covering operations and maintenance for the NEE Course. This training will be ongoing for the next 20 years.
- There will be no paper TMs to support NEEC; only IETMs will be issued for equipment support.
- The acquisition manager has independently funded an Electronic Classroom pilot.
- The Project would eliminate the need for tactical hardware in training. Migration of training from classroom to submarine would result. Ultimately, elimination of tactical trainers and their associated costs (maintenance, facility construction, fixed locations, operating expense) could be realized.
- The paperless classroom initiated by SP-11 is a fully funded program that upgrades the navigation subsystem on Trident II SSBNs. This upgrade includes IETMs with no paper back-up. IETMs will be Class 4, compliant with MIL-97268, MIL-87269, and MIL-87270. Scheduled IETM delivery is early FY 98.
- At the same time, the Fire Control Subsystem (FC) will undergo an update. The program manager also intends to support the new equipment with Class 4 IETMs, MilSpec-compliant. The time frame for delivery is early FY 98. Equipment that is not upgraded (legacy data) will also be supported by IETMs developed by the cognizant contractors.
- Data acquisition for training and IETM development would be overseen by a single program manager, and the effort would be performed on a life-cycle basis by the same prime contractors.

Comments:

CP-15 appears to be a sound proposal, although the relationship of VE to IETMs/ICW is not made clear. There would be no infrastructure investment. SP-11 will fund the development of the paperless classroom. Only the additional functionality for the VE (not included in the current SP-11 design) would require additional funding. This program would fund an operational capability for SP systems, but might not involve technology that would transfer to other programs. The Project has to be considered on its own merits. The production of immediate hard savings to the broader Training Community is not clear.

CP-16

Candidate Project: Automation (IETMs) of Legacy Data

Revised Title: Develop IETMs from Legacy Data to Supplement IETMs Being Acquired for the
SSBN Navigation System Upgrade

POC: D. Stephenson/J. Himes

Organization: SP24/SP11

Summary:

As part of the SSBN navigation subsystem upgrade, new equipment will be supported by IETMs. Not all components will be new, however, and there is no plan at present to automate the legacy data. Thus, both IETMs and paper TMs would be used in the classroom. CP-16 proposes to provide IETMs for the non-upgraded equipment. The effort includes provision of a site to evaluate, measure, modify, and upgrade a completely paperless classroom environment without the expense of supporting the infrastructure of that classroom which is already being funded.

Characteristics:

- Electronic Classroom development is planned and funded for FY 96/97.
- The contractor is currently using AIM for constructing courseware, and IETMs are planned. Other IETMs already exist. IETMs will be compliant with MIL-87269, with COTS hardware and software.

Expected Payoffs:

- Training can be shifted from classroom to submarine.
- More effective training can be achieved due to effectiveness of electronic media.
- Storage requirements can be reduced.
- Configuration management can be improved.
- Classroom utilization can be increased.

Investment:

- Includes cost of developing IETMs from TMs that are not part of subsystem upgrade. Anticipated cost (for a Class 3 implementation) is less than \$2 million.

Life-Cycle Cost:

- None. Program Manager will provide funding.

Comments:

- CP-16 appears to be an expansion of CP-17 to provide a complete suite of IETMs. Without CP-16, CP-17 would not provide IETMs for the entire Navigation Subsystem. It is recommended that this Project be treated as a part (possibly in Phase II) of CP-17.
- CP-16 may provide a relatively low training contribution, being primarily an IETM effort; however, it may be necessary to provide an all electronic support system to carry to the submarine. It will be a hybrid Class 3/4 implementation, but under a common architecture (a major contribution in itself.)

CP-17

Candidate Project: Integrate IETMs with ICW and AIM

Revised Title: Integrate Existing IETM and ICW for the SSBN Navigation System Upgrade

POC: D. Stephenson/J. Himes

Organization: SP24/SP11

Summary:

As part of the Navigation Subsystem upgrade, the new equipment will be supported by IETMs. AIM is already used to create training curricula, and ICW has been produced to support the present equipment. It is anticipated that the associated paperless-classroom project will allow the use of ICW and IETMs. There is, however, no current provision for integrating IETMs with ICW-produced courseware, or for using IETMs to help develop training curricula by integrating AIM with the IETMs. CP-17 would develop a state-of-the-art training environment, without the full expense of the paperless classroom, which is already funded.

Characteristics:

- Electronic Classroom development is planned and funded for FY 96/97. Scheduled IETM delivery is early FY 98.
- The contractor is currently using AIM for courseware construction, and IETMs are planned. Other IETMs already exist.
- Contractors are already developing training curricula using AIM system and have produced IETMs and ICW.
- Class 4 IETMs would be compliant with MIL-87269, using COTS hardware and software. There will be no paper TMs to support NEEC.
- Training covers operations and maintenance for NEEC. This training will be ongoing for the next 20 years.
- The Fire Control (FC) subsystem will also undergo an update, similar to that of the Navigation System (i.e., Class 4 IETMs, Mil Spec compliant).
- Improvements would be quantifiable (based on long history and statistics reflecting the use of conventional training methods for this system over the last 20 years).
- Data acquisition for training and IETMs would be overseen by a single program manager and performed on an integrated life-cycle basis. With a single program manager, the compatibility of the tactical IETM/ICW/VE display device with the paperless classroom would be assured.

Comments:

CP-17 is a solid proposal, highly leveraged by existing SP-11 plans. CP-17 should combine with CP-16 (possibly as a Phase II) which intends to convert IETMs for the legacy-hardware components to create an overall paperless electronic training support system.

CP-18

Candidate Project: AN/SQQ-89(V) Sonar System IETM Development

Revised Title: Develop IETMs (Already Planned) and Integrate Them into Existing ICW/ECR Environment for the AN/SQQ-81(V) Sonar System

POC: B. J. Silvey / Don Alford

Organization: PMO411 / FLEASWTRACEN(N8)

Summary:

- The AN/SQQ-89(V) Surface ASW Suite maintenance curriculum is currently being rewritten as computer-based interactive multimedia courseware. As its FLEASWTRACEN classrooms become more automated, the need to include an Interactive Electronic Technical Manual to enhance the computer-based training is becoming more and more critical.
- The proposed effort involves the development of an IETM for the AN/SQQ-89(V) ASW Suite maintenance curriculum to enhance the instructional approach, streamline the curriculum, and improve usability.

Characteristics:

- Automated ICW classrooms are:
 - On-line and implemented with high throughput (700 students/annum), with reduced Technical Training Equipment (TTE) cost and reduced pipeline.
 - Exported to Afloat Training Centers (ATCs) and ships to provide just-in-time and on-demand training.
- Phase I of the IETM plan has been completed including legacy-data digitization; however, in its current form the TI does not integrate well with the ICW. At least a Class 3 IETM is needed.
- Currently, eight automated classrooms are available at FLEASWTRACEN to support Rate training, eight to support operator and C-School maintenance training, and ten to provide additional operator and maintenance classrooms. Five additional classrooms are being installed at the Afloat Training Centers to support Fleet refresher and proficiency training.
- The proposed IETMs will support six courses of instruction totaling approximately 100 weeks of training with an approximate annual throughput of 700 students.
- Cost benefits include elimination of outdated TTE and other training devices with the subsequent savings associated with utilities and maintenance of this TTE.

Comments:

- One of the best proposals, CP-18 seems to be not only a candidate for Phase II but also a candidate for early funding, if possible.
- This proposal is written as a large-scale Fleet demonstration. If successful, a total conversion of all surface ASW Technical Information appears to be in mind.

CP-19

Candidate Project: IETM Site, Facilities and Life-Cycle Support

Revised Title: NAVSEALOGCEN IETM Site, Facilities and Life Cycle Support
Standardization

POC: Ray Brown, DSN 430-4000 or Commercial 717-790-4000

Organization: Naval Sea Logistics Center

Summary:

CP-19 proposes to apply facility support practices developed by the Naval Sea Logistics Center, Training Systems Group, to IETM-based classrooms.

Characteristics:

- It is proposed to standardize installation of IETMs to support training requirements in accordance with procedures and practices developed by the Naval Sea Logistics Center, Training Systems Group (N30).
- The effort includes surveying prospective sites (buildings/rooms), developing design plans, taking receipt of the equipment, and installing it and any associated support equipment. It will provide a single, standardized, and cohesive approach to installing and supporting IETMs.
- Standardization would be accomplished in the look and feel of the IETM-based laboratories. Air conditioning, heating, and lighting would be provided to support specific teaching objectives.

Investment:

- Minimal

Life-Cycle Investment:

- Minimal

Comments:

- CP-19 appears to be well thought out and defensible, but does not produce specific savings in training through the use of IETMs. It addresses an important facet that deserves attention but not in this particular study.
- This proposal seems more concerned with the plant, software, and hardware than with the infrastructure functionality, which would have to be defined first.

CP-20

Candidate Project: Advanced Integrated Electronic Warfare System (AIEWS)

Revised Title: Develop IETM/ICW for the Advanced Integrated Electronic Warfare System (AIEWS)

POC: EWCS (SW) Larry Rouse

Organization: Program Executive Office Theater Air Defense

Summary:

CP-20 proposes to develop IETMs, ICW, and a Technical Information database for the phased upgrade to the AN/SLQ-32. Current plans call for IETMs, and a team is now investigating IETM development. Plans include using the IETM to develop ICW for use in an Electronic Classroom for Schoolhouse training.

Characteristics:

- AIEWS is a phased program of improvements for the AN/SLQ-32. The major change will be a new console that will use UNIX-based software. Phase I would reach the Fleet in FY 98, with Phase II following in FY 02, and Phase III in FY 05.
- The system includes a combination of new and legacy data for which data recorded on magnetic media have been developed. Training will be built on the existing curriculum.
- The console selected will be the same as that used for all new combat-system developments. Training developed can be used for the Advanced Display System (ADS) of the Ship Self Defense System (SSDS), plus AEGIS systems under development.
- The training concept used in the Schoolhouse would be directly exportable to the ship, permitting "training on demand" in support of both PMS and corrective maintenance.
- The IETM would be aboard every surface combatant and would share hardware commonality with AEGIS, SSDS, and several other programs.
- IETM and training software would consist of three separate but interrelated units: the Technical Information, the IETM shell, and the ICW shell. The IETM shell would be oriented toward maintenance and troubleshooting while the ICW shell would have animation and overlay capabilities to allow classroom or remediation instruction. Specific modules could be aimed at alignments and maintenance procedures or refresher training for shipboard use.

Comments:

Apparently CP-20 proposes to supplement the already planned resources for developing IETMs and ICW for the AIEWS. The opportunity here would be to augment existing funding to assure that the developed system would optimally unite IETMs and training into a model program, an action which would probably require additional design and planning. The ongoing program is in an early stage and could be modified. However, it would be difficult to isolate the specific benefits resulting from this proposal that would accrue to training compared with the results of not supplementing the PM's resources and proceeding with current plans alone.

CP-21

Candidate Project: AEGIS Class 4 IETM Conversion for CG-59 to CG-73 and DDG-51 Class Ships

Revised Title: Conversion of TMs to IETMs for AEGIS Weapon Systems on CG-59 to CG-73 and DDG-51 Class Ships

POC: Daniel Seemiller/Gary Whitsell/Gary Mahler

Organization: NSWC PHD; AEGIS PM/ATC

Summary:

This effort proposes to convert the entire suite of AEGIS Weapon System (AWS) TMs to Class 4 IETMs for both onboard use and for training in existing Electronic Classrooms at the AEGIS Training Center.

Characteristics:

- Work is underway at the AEGIS Training Center (ATC) and the prime contractor to integrate Instructor's Guides and training support materials into the already developed AEGIS Fire Control System (FCS) Pilot Program IETM. The Electronic Classroom at ATC provides a ready platform to accept the proposed, modified IETMs.
- ATC, Dahlgren, is responsible for training the personnel of 23 cruisers and 29 destroyers. Use of IETMs would result in major cost avoidance.
- A currently planned but unfunded AEGIS POA&M through FY 2000 includes conversion of all NSWC PHD AEGIS combat-system TMs (approximately 1000 volumes) to IETMs.

Expected Payoffs:

- Reduced length of training.
- Training modules incorporated into IETM.
- More space made available at training sites and on-board ships.
- Better utilization of TM information for training and maintenance.
- Reduced effort to create baseline TMs for future ships.

Initial Investment:

Very large, estimated at \$100 per page (or less) for conversion today of more than 400,000 TM pages to Class 4 IETMs. Semi-automated conversion into Class 4 format would result in lower conversion costs. Portable computers would be required: \$7,000 or less per computer, at 3 per ship, for 43 ships.

Comments:

CP-21 is for total conversion of AEGIS Weapon System TMs to IETMs. The size of the proposed effort is well beyond the scope of this study. Specific savings claimed in training are general and not specific. Because of the very large cost, this effort would first have to be justified on savings in life-cycle maintenance of the AEGIS Weapon System. It is considered that CP-22, submitted by the same Activity, is scoped much lower and should be the Candidate to consider rather than CP-21.

CP-22

Candidate Project: AEGIS Class 4 IETM Conversion for AEGIS Baseline 6 Phase I on DDG-79, to backfit on all DDGs

Revised Title: IETM Conversion for AEGIS Weapon System Baseline 6 Phase I TMs on DDG-79

POC: Daniel Seemiller / Gary Whitsell / Gary Mahler

Organization: NSWC PHD / AEGIS PM/ATC

Summary:

Convert AEGIS Weapon System (AWS) TM legacy data for the DDG 79 to Class 4 IETMs, and provide new IETMs for the Baseline 6, Phase I, version of AEGIS, as required. IETMs for this version of the AWS would be used on follow-on ships and eventually backfitted on all AEGIS ships. The Electronic Classroom at ATC provides a ready platform to accept to the proposed IETMs and accrue benefits from the conversion.

Characteristics:

Work is underway at ATC and the prime contractor to integrate Instructor's Guides and training support materials into the AEGIS Fire Control System (FCS) IETM already developed

Expected Payoffs:

- Reduced length of training.
- Training modules incorporated into IETM.
- More space made available at training sites and on-board ships.
- Better utilization of TM information for training and maintenance.
- Reduced effort to create baseline TMs for future ships.

Initial Investment:

Conversion of legacy TMs to Class 4 IETMs would cost about \$100 per page for about 25,000 TM pages, plus the cost of developing supplemental ICW. The total cost would be about \$3.5M. Portable computers would cost \$7,000 or less per computer, three per ship. Additional training would be required for instructors.

Comments:

- CP-22 would be an AEGIS Pilot converting all TMs to IETMs for the newest version of the AWS (Baseline 6, Phase I), to be installed on a ship under construction. This is an ideal window of opportunity for the AEGIS Weapon System. This version of the AWS will eventually be backfitted on all AEGIS ships. At this time, ATC is conservative in its claims as to specific savings in the training pipeline, but believes significant benefits are to be accrued.
- CP-22 is recommended for consideration over CP-21 which is a proposal to convert all the AWS TMs to IETMs at a much larger cost.

CP-23

Candidate Project: DoD IETM Guide

Revised Title: Preparation of a DoD IETM Acquisition and Preparation Guide

POC: Harvey Thorstad, 407-280-8324

Organization: NAWCTSD

Summary:

Develop an IETM acquisition and preparation guide to complement the existing ICW guide (MIL-HDBK-284) based on an existing effort at NAWCTSD.

Characteristics:

- A draft of the IETM acquisition and preparation guide already under preparation, and will be in draft form in December 1995. It will relate directly to training using input from existing Electronic Classrooms and other sources. The proposed task will circulate the draft IETM Guide to other Navy and DOD Activities, solicit review comments, resolve comments and issues, and produce a final guide.
- The acquisition manager has already funded the preparation of the draft guide. CP-23 has been coordinated with CNO (N879) George Horne.

Investment:

A sponsor is needed to fund and "champion" the guide through DOD review, a process which would entail:

- reproduction, distribution, collecting of comments;
- collating/resolving comments;
- proceeding through the steps required to produce a guide applicable to the whole DOD; and
- distributing the final guide.

Comments:

- CP-23 would undoubtedly be very useful, especially if coordinated throughout the Navy; however its effect on training benefits is secondary. Only specific programs using it would accrue benefits. It is not really within the scope of Candidate Projects intended for this study.
- It is not recommended that this effort be studied as part of the Phase II study effort.

CP-24

Candidate Project: Using IETM Data to Support Job Performance

Revised Title: Investigate the Applicability of IETMs for Use with Hand-Held Personal Display Adaptors (PDAs) for the Trident II Navigation System

POC: Jim Chenvert, Loral, 703-620-7501; jimc@reston.unisys.gsg.com

Organization: PMS 396/SP11/Loral

Summary:

The advantage of using IETMs for the Trident II navigation subsystem is fairly clear for the classroom, but for the sailor carrying out hands-on maintenance in the training laboratory, or maintaining equipment on the submarine, the benefits of IETM implementation are less clear. CP-24 is meant to solve the problem by constructing the IETM in a way that allows the applicable portion to be downloaded to a hand-held Personal Display Adaptor (PDA).

Characteristics:

- CP-24 will provide a job-oriented structure to the IETM database which would support on-board equipment maintenance as well as classroom training, interactive courseware, and onboard operation and maintenance.
- This effort is proposed as a pilot program, coordinated with existing program components, including IETM development, the use of AIM for courseware construction, and Electronic Classrooms.

Comments:

- This candidate pilot would be a very interesting one, addressing a key, needed capability not automatically obtained when an IETM is developed. It would be desirable to assure that the on-the-job-aiding and real-time-training concept is viable. However, it is more of a technology-development item and not a technology-insertion item as envisioned by this study effort, and is not recommended for further study under this task.
- As written, the benefits of CP-24 focus on IETM performance in the Fleet rather than on training benefits.

CP-25

Candidate Project: Integration of Training Material with IETM

Revised Title: Integration of Training Material with IETM for NATO Sea Sparrow Missile System (NSSMS).

POC: Erlinda Reyes

Organization: NSWC PHD, Code 5A32

Summary:

For the NATO Seasparrow Surface Missile System (NSSMS) and Target Acquisition System (TAS) documentation programs, CP-25 proposes to develop already planned IETMs and integrate them with the training curriculum in order to reduce the printing and storage cost of hardcopy of TMs and training information required to support the school.

Characteristics:

- The NSSMS documentation is to be rearchitected in FY 97, and the NATO Seasparrow Project Office is willing to convert the NSSMS logistic support documentation into IETMs to support the new configuration. 50 percent of the NSSMS documentation is already in digitized form and 100 percent of the TAS TMs are in this form.
- CP-25 is proposed by the office responsible for assembling the TM and training support material for the NSSMS Courses.

Claimed Savings:

Reduction in maintenance, storage, printing, and distribution costs of training materials by 50 to 65 percent.

Comments:

The information received by the study team was from the Activity assembling the training package, which has rightly concluded that their job would be greatly reduced if the courseware were in electronic form. Savings would be assured but relatively small. There may be an opportunity to revise the Seasparrow training program at the time that the TMs are being revised; however, the study team was not able to meet with the logistics managers to explore this option. CP-25 is not recommended for further consideration in the present study unless and until additional information regarding the possibility of redesigning the training program is secured from the NSSMS logistics managers.

CP-26

Candidate Project: Computer Based Training (CBT) for the Maintenance of the DC-9 Aircraft

Revised Title: Enhance Existing CBT with IETMs for the Naval Air Reserve Force

Maintenance Training for the DC-9 Aircraft

POC: CDR Dabrowski

Organization: Naval Air Reserve Force

Summary:

Computer-based maintenance training for the DC-9 aircraft is currently being produced under Navy contract. The CBT will be used primarily for maintenance training in the squadrons (seven Reserve squadrons consisting of 29 aircraft and 2,100 personnel), and at the USAF Schoolhouse at Scott Air Force Base. The Air Force has piggy-backed onto this contract. CP-26 would convert the DC-9 Technical Manuals to IETMs. Without the IETMs, the CBT will be severely limited in its usefulness as a tool for the training of troubleshooting.

Characteristics:

- The DC-9 CBT is based on the DC-8 CBT used by United Parcel Service (UPS). UPS found tremendous savings in parts and Mean Time To Repair (MTTR) by using the DC-8 CBT for troubleshooting their aircraft systems.
- The DC-9 CBT is not currently planning to incorporate IETM-based materials into its training programs, primarily because of limited funding.
- By providing IETM-based training materials, training improvement would be realized within two years. Reservists currently do not attend formal Schoolhouse courses, and the realization of the objectives of CP-26 would provide a tremendous improvement in the quality of training.
- Significant savings in parts and greater aircraft availability are expected by the use of the DC-9 CBT for troubleshooting.
- Significant cost avoidance is expected from using DC-9 CBT to train the selected reservists at the squadron instead of sending them to the USAF Schoolhouse at Scott AFB.

Comments:

- The chief training benefit resulting from CP-26 would accrue from using the integrated IETM/CBT as a training tool at the squadron locations, thereby eliminating the need to send selected technicians to Scott AFB for Schoolhouse training. More information is needed to reliably define the Return on Investment, but if it is substantiated, CP-26 would make a very worthwhile project.
- Since the CBT effort is already well funded the only cost would be the conversion of existing TMs to IETMs and converting and integrating with the CBT.

CP-27

Candidate Project: Surface Combatant Flexible Fire Control System Integrated IETM/ICW

Revised Title: Convert Paper TMs and Training Materials to IETM Format for the Surface Combatant Flexible Fire Control System

POC: Joseph Kowalski, 804-686-7812

Organization: NRaD

Summary:

As part of an upgrade plan for Surface Fire Control Systems (MK34) and 5" Gun System (MK45), CP-27 proposes to convert legacy TMs and legacy training data from hardcopy to an IETM format; and concurrently to develop Interactive Courseware and Training Curricula linked to the IETM. Existing Navy and Schoolhouse resources at the Fleet Combat Training Center (FCTC), Dam Neck, VA, will be used to facilitate this effort.

Characteristics:

In-house resources are available: Navy civilian ISEA personnel, military instructors, surface fire-control Subject Matter Experts (SMEs), Instructional Systems Development Personnel, the Authoring Instructional Material (AIM) system, Interactive Courseware development assets, and computer-based learning centers and Electronic Classrooms are in use by FCTC, Dam Neck.

- This approach requires minimal investment in infrastructure.
- It uses lessons learned and corporates knowledge from AN/BSY-2 and LM-2500 Gas-Turbine IETM and training programs.
- Cost avoidance resulting from specific improvements will be realized within the FY 97 through FY 99 time frames.
- All Flexible Fire Control platforms (more than 50 percent of surface combatants) would be implemented. The Project will cross-utilize FCTC assets which are currently under-utilized.
- Planning for the update for the Flexible Fire Control System mandates an IETM evaluation. However, integration of IETMs with electronic training material is not mandated, but it has been considered.

Payoffs Expected:

- Reduce Schoolhouse procedure-training time by at least 30 percent.
- Reduce Schoolhouse instruction time by 25 percent.
- Reduce course duration by 25 percent.
- Reduce academic attrition by 65 percent.
- Increase classroom utilization by 50 percent.
- Reduce training time and cost of training staff by 80 percent.
- Decrease ratio of instructor prep time to class time by 60-80 percent.
- Reduce life-cycle support costs with acquisition and maintenance of training products by 50 percent.
- Reduce time required for maintenance of automated training materials by 50 percent.
- Reduce the time and cost to prepare original training information by 50 percent or more.
- Reduce storage space required for paper TMs by 90 percent.
- Increase job proficiency of newly trained technicians by 15-20 percent.
- Reduce combined cost of ICW training materials and IETMs by 50 percent.

Investment

Only labor costs associated with the development and acquisition of IETM/ICW are expected. No other investments are required. NAVSEA 91W2 already has access to IETM/ICW development assets. The existing training hardware is in place in classrooms at FCTC. Outfitting of platforms with IETM hardware/software and associated maintenance/upgrade and logistics support will be required. Maintenance of curricula will be performed by the Schoolhouse.

Comments:

CP-27 appears to be one of the better candidates. Further study is needed to evaluate the investment/payoff time table. The proposal assumes the maturity and portability of the capability being acquired for maintenance of the LM-2500 Gas Turbine System IETM at Great Lakes.

Candidate Project: Mine Counter-Measures (MCM) IETM

Revised Title: Transfer the MCM Electronic IETM-based Shipboard Environment for Training to Schoolhouse Training Ashore.

POC: Clifton Mitchell, Jr.

Organization: PMO 407L5

Summary:

The current MCM training program ashore is paper-based, but the training environment aboard the MCM ship is electronic, including the use of IETMs. CP-28 proposes to “flow” the integrated shipboard logistics environment from the Fleet to shore-based training facilities. The proposed effort can thus measure the benefits obtainable from developing a continuum of training environments from ashore to afloat. The plan includes the entire electronic infrastructure, including the Electronic Classroom, instructor training, and IETM/ETM maintenance functions.

Characteristics:

- The decision has already been made to convert the MCM to a paperless ship and the acquisition manager is moving in this direction. The decision has also been made to develop the complete shipboard architecture required to support a training environment. The use of IETMs is a key element in this solution. The required shore-based infrastructure has not as yet been programmed.
- The continuum of training technology from afloat to ashore requires that benefits be achieved rapidly to take full advantage of the technical team assembled to develop the automated shipboard environment before it is dispersed.
- The effort proposes integration of IETMs with other media applications and library environments.

Comments:

The requirement for CP-28 is very solid. It is not sensible to implement an electronic training-support system on a ship without including it in Schoolhouse training. However, it may not be within the scope of the current study effort to remedy situations such as this.

CP-29

Candidate Project: AN/BQG-5 Passive Sonar Receiving Set (ACAT I Acquisition)

Revised Title: Develop an IETM and Embedded Curriculum Package for a New Version of the AN/BQG-5 Passive Sonar Receiving Set

POC: Al Allen, PMO 41821

Organization: PEO Subs PMO 418

Summary:

PMO 418 is currently evaluating proposals for the development of a commercial version of the AN/BQG-5 Passive Sonar Receiving Set. The technical requirements for this system require the development of an IETM, including an integrated curriculum package. This system will be installed on approximately 30 ships including both backfit and new installations. This effort should be considered a new-development IETM for a system which will include a high percentage of commercial, off-the-shelf equipment.

Characteristics:

- The Navy Submarine School (New London, CT) will conduct the training; the Electronic Classroom, using AIM-generated courseware, is in place. A high student throughput is expected from 30 or more submarine systems.
- The product would be used in both Schoolhouse and shipboard environments.
- The training plan for the AN/BQG-5 is being updated.
- The Navy is now in the source-selection process and intends to procure this system.
- An experienced logistics staff, which prepared the AN/BSY-2 IETM, already exists.

Expected Payoffs:

The PMO 418 Program Office expects the same payoffs as those which were associated with the AN/BSY-2 IETM and the first/second AN/BQG-5 acquisitions. Specifically:

- Reduced course length by 30 percent (6 weeks to 4 weeks).
- Reduction in MTTR of 17 percent
- An increase in technician proficiency and retention.

Comments:

CP-29 is a very solid proposal which seeks to extend proven benefits of integrated IETMs for the AN/BSY-2 to the AN/BQG-5 upgrade program. However, it may not be in the scope of this study to include solid efforts such as this, which would reasonably be expected to be funded by the acquisition program manager.

CP-30

Candidate Project: Gas Turbine Electrician and Mechanical Training Environment

Revised Title: Provide and Institutionalize Life-Cycle Support for the LM 2500 Electronic Classroom at Great Lakes

POC: Bob Calogero / Harry Felsen

Organization: NAVSEA 04MP / NAVSEA 04TD

Summary:

CP-30 would develop an infrastructure to employ the existing LM-2500 Gas Turbine System (GTS) IETM at Great Lakes as the "model" for Navy training using IETMs based on legacy TMs. This effort would "institutionalize" the Great Lakes Electronic Classroom, instructor training, and the IETM/ETM maintenance environment for Navy shipboard implementation within a library environment (i.e., ATIS).

Characteristics:

- Many of the relevant efforts are partially completed. However, additional effort is needed to fully complete and document the program as a "model". This effort needs "immediate" funding attention and cannot wait until POM '98 because valuable contractor knowledge and experience would be lost before it could be assumed or transferred to the Navy.
- The plan is based on the existing GTS training program. It includes Schoolhouse effort as well as IETM development and shipboard implementation.
- The effort would document the lessons learned so far in using the GTS IETM for training, and would continue to fully document cost benefits for development, training, and life-cycle support.

Benefits Claimed:

- 30-percent reduction in C-School training with 6 - 7 percent increase in grade-point average.
- Payoff in dollars per year in training of GT ratings is claimed to be \$3 - 5M "additional" per year in indirect account burden.

Investment:

The proposal requests a maximum of \$3M additional to complete the pipeline, document the processes involved, and establish a "turnkey" maintenance environment for Great Lakes SSC and NSWC/CD Philadelphia.

Comments:

CP-30 appears to be very sound; however, it is based on the premise that the GTS IETM "success story" is proven, that it represents the best training solution for other systems, and that it is portable to other programs. Because of the high level of resources requested to effect this institutionalization, and the fact that such an institutionalization is hard to change, once established, it is recommended that the results of the several independent evaluations of the GTS experiment currently underway be included as an essential part of any follow-on study dedicated to this proposal.

CP-31

Candidate Project: AN/APG-65 Radar IETM Integration with Training

Revised Title: Integrate the AN/APG-65 IETM with AIM-Developed Instructor and Student Guides and CBT

POC: Martin Bare / GySgt Howard Blair

Organization: Naval Air Systems Command AIR 3.6.1.2

Summary:

An IETM for the AN/APG-65 radar was scheduled for completion in July 1995. Using this IETM, CP-31 proposes to:

- Implement the use of the IETM in the classroom
- Use AIM with the IETM database to develop Instructor's and Student Guides
- Interface CBT and the AN/APG-65 IETM to provide in service training at squadron sites.

Characteristics:

- An AN/APG-65 IETM has been developed as part of a large-scale demonstration which, if successful, would be used as the basis for the overall electronic Technical Information support system for future NAVAIR system acquisitions such as the F/A-18E and F/A-18F. The proposed CBT/IETM project would be evaluated for such an application and would provide a production capability for the existing training program for the AN/APG-65.
- The AN/APG-65 is used on Navy and Marine F/A-18s and on the AV-8B. Student throughput at Cecil NAS and Lemoore NAS C-Schools is estimated at 468 students in FY 96, with 37,908 hours spent on AN/APG-65 training.

Expected Payoffs:

The proposal estimates a 15 - 30 percent improvement in effectiveness of maintenance and training through use of this training package.

Investment:

\$600,000, based on a fully developed but unfunded proposal already in place. An additional \$150K may be required for in-house technical monitoring to assure that the solution would serve as a model for other NAVAIR IETM/CBT integration efforts.

Comments:

- CP-31 is a sound extension of developmental work already underway relating to the IETM portion of the task. It is positioned to be the model system for NAVAIR new system acquisitions. It is the best of the NAVAIR Candidate Projects submitted.
- This proposal can also be considered as a Phase I of CP-47, the proposal to develop integrated IETM/CBT for new-acquisition F/A-18E/F aircraft.

CP-32

Candidate Project: Standardization of Qualification Training for Advancement-in-Rate

Revised Title: Development of the All-Electronic Data Environment for Qualification Training for Advancement-in-Rate

POC: C. W. Hesse

Organization: NETPMSA

Summary:

As part of an overall training continuum, use IETM technology to create an automated system for the enrollment, delivery, administration, evaluation, and reporting of candidate performance in the Qualification Training for Advancement-in-Rate.

Characteristics:

- IETM portions of this system would include OCCSTD-based interactive electronic training materials that include Rate Training Manuals (TRAMANs) with embedded exercises, followed by automated End-Of-Course (EOC) examinations.
- This system, which should be (1) constructed with open architecture, (2) standards-based, and (3) non-proprietary, should be controlled by a global Database Management System (DBMS). This DBMS would manage all of the administrative functions related to student enrollment, tracking, and course reporting, as well as being a gateway to IETM databases that are used to develop the materials.
- The effort would have Navy-wide impact.
- NETPMSA is presently conducting a beta-test of 24 volumes of NEETS electronic training manuals.
- Usage figures are available for OCCSTD-developed materials.
- NETPMSA has been identified as a JCALS site with full deployment in FY 97. JCALS infrastructure is presently in place, but will require additional hardware and software to accommodate the increased network traffic. The present infrastructure has direct links to Great Lakes SSC.

Payoffs Expected:

- Navy-wide standardization of Qualification Training for advancement.
- Guaranteed baseline of knowledge prior to Advancement-in-Rate.
- Currency of training materials concurrent with IETM database.
- Navy-wide introduction to electronic books.
- The EOC examination permits the American Commission on Education (ACE) to evaluate materials for award of college credit. This can subsequently result in cost avoidance of tuition assistance.
- EOC examination data will close the Instructional System Development (ISD) loop and provide objective course evaluation.
- Cost avoidance in printing, storage, and distribution.

Comments:

- Most of the IETM-based Candidate Projects are weapon-system oriented. This proposal focuses on the more general area of Rate training.
- CP-32 proposes that most functions relating to Rate Training be included in one digital environment: an excellent concept. The digital environment would be much more than an IETM, but it clearly includes the substance of the Rate Training Manuals in IETM form.
- CP-32 is the primary CNET proposal. It is considered an excellent proposal.

CP-33

Candidate Project: AMO School Intradivision LAN and Projection System

Revised Title: Develop an Electronic Classroom for the Aviation Maintenance Officer (AMO) School

POC: Lt. Joseph G. Davis/Stacy Cummings

Organization: Naval Air Systems Command / NASC 62229

Summary:

Procure and set up a Local Area Network (LAN), a projection system, and supporting hardware/software for the AMO School in such a way as to provide student access to ATIS, IETMs, NALCOMIS, the Naval Aviation Maintenance Plan (NAMP), and other maintenance-related directives and instructions.

Characteristics:

- The proposed LAN and classroom projection system includes:
 - Server and backup server
 - Three ATIS workstations with network software
 - 75 student workstations (3 classrooms, 25 each)
 - 15 instructor workstations (three classroom, 12 office)
 - One tower holding 30 CD-ROMs
 - Three overhead-projection systems
 - Three laser printers
 - 75 student-workstation desks.
- The proposed system would support both the Aviation Maintenance Officer (AMO) indoctrination and management courses.
- Student throughput for indoctrination and management courses is 320 annually with the capacity for 375.
- The system would be merged with the existing training program, and would enhance existing ICW applications (e.g., interface with NALCOMIS). Additionally, this proposal will establish an ICW infrastructure for future growth; e.g., fully interactive course materials for instruction, testing, and remediation.
- The proposal is in the formal chain for approval as of 1 June 95. The CNO goal of a paperless NAMP by FY 98 makes this Project a requirement for the AMO school.
- Training efficiency would be achieved through instant access to NAMP, IETMs, and other publications, directives, and instruction databases. Benefits would be realized by both instructors and curriculum developers.

Investment

- Initial: \$325,767
- Life-Cycle: \$ 10,700 annually

Comments:

A relatively small proposal. Specific contribution of IETMs in this electronic environment is not made clear. CP-33 appears to be a proposal for infrastructure at the AMO school which would serve many purposes. The potential benefit appears high, but more information is needed to demonstrate that this effort would produce benefits caused by accelerated use of IETMs.

CP-34

Candidate Project: Phalanx Integrated Maintenance System Electronic Classroom Training (PIMS ECT)

Revised Title: Add an Existing IETM to an Existing Electronic Classroom for the PIMS ECT Program

POC: C. R. Hartz, CLF N76, 804-444-6149

Organization: CINCLANTFLT / COMTRALANT

Summary:

Install an Electronic Classroom composed of sixteen student stations and one instructional station at the Fleet Combat Training Center, Virginia Beach, VA, to implement the use of an existing IETM in Phalanx Integrated Maintenance System training. Specifically, integrate an existing IETM into the initial 29-week C-School course. Schoolhouse training with this IETM is funded, once the ECR is provided.

Expected Payoffs:

- Possible 35-percent reduction in course length (individual account saving).
- Reduced storage space required for paper Technical Manuals.
- Better technically qualified technicians.
- Reduced AOB (IA account, MPN).
- Better use of understaffed instructors.

Investment:

\$500K

Comments:

CP-34 proposes applying infrastructure funding to add an Electronic Classroom in order to use the CIMS IETM in classroom instruction. No real developmental risk is involved. Because of the claim of significant course-length reduction, this Project is considered for additional study.

CP-35

Candidate Project: AN/BSY-1 IETM/ICW Interaction

Revised Title: Develop an IETM-based Training Pilot for the AN/BSY-1

POC: John Storvick

Organization: NUWC - Newport Division

Summary:

Accelerate the acquisition of a segment of the AN/BSY-1 IETM and include the addition of IETM-based training materials. The current training and technical documentation are available in various forms: paper, AIM-produced courseware, proprietary ICW, etc. Use this pilot effort to evaluate the effectiveness of automated training materials as compared with conventional training materials.

Characteristics:

The AN/BSY-1 IETM program plan has a scheduled IOC of FY 2001. IETM introduction will have a significant Fleet impact because of the large number of AN/BSY-1 platforms.

Expected Payoffs:

- CP-35 could demonstrate:
 - A 30-percent reduction in training time required to achieve targeted technician competence.
 - A 10-50 percent reduction in use of TTE for teaching.
 - A higher level of OJT to support the submarine forces' need to send non-C-School graduates to sea, with only basic-skills training.
- It could determine whether an FT or STS could work in a cross-rating environment and could achieve a 30-percent increase in utilization of the AN/BSY-2 Electronic Classroom.

Investment:

\$500K.

Comments:

CP-35 is a pilot implementation to accelerate development of the IETM (with integrated training modules) for a portion of the AN/BSY-1 with use of the resulting IETM/training product in an evaluation mode in the Schoolhouse and on submarines. It is an excellent Project as it will also test OJT effectiveness for A-School-only graduates and will assess the use of IETMs to lower the risk of combining Ratings. However, no specific benefits are expected until the AN/BSY-1 Fleet introduction starting in 2001.

CP-36

Candidate Project: Electronic/IETM-Based Training to Fleet Mine Warfare Training Center
Revised Title: Establish Electronic/IETM-Based Training at the Fleet Mine Warfare Training Center (FMWTC)

POC: Bob Calogero/Jeff Ornd

Organization: NAVSEA 04PT / PEO-MIW

Summary:

Establish a Total Electronic Virtual-Training environment at the Fleet Mine Warfare Training Center, Ingleside, TX.

Characteristics:

- The FMWTC teaches 22 mine-warfare-related courses. 16 of these are candidates for conversion to IETM-based training or multimedia-based (CBI/ICW) training. Also, it is proposed to add training for the MN (Mineman) rating.
- PEO-MIW and NAVSEA are in the process of converting all MCM TMs to Class 2 ETMs, with two critical combat systems and the Issotta-Francini diesel engine going to Class 3 IETMs (training curricula included). The effort is now in Phase II of establishing a common hardware/software infrastructure for a "shared data environment" that will permit data retrieval, system interoperability, distance learning, and life-cycle management.
- The effort will meet classroom/shipboard training needs, including those for training for the MN (Mineman) rating.

Expected Payoffs:

- Reduced training times.
- Better student performance.
- Virtual continuum of training - classroom to ship.
- Just-in-time training capability.
- Elimination of some courses through the use of multimedia.
- Improved onboard technician performance.
- Integrated data environment between training.
- Technical communities; common (interoperable) hardware/software infrastructure.

Investment:

- Analysis and revision of curriculum for Instructor's and Student Guides.
- Hardware infrastructure for classrooms.
- Limited hardware/software support infrastructure.
- Minor systems integration (conversion of AIM to permit IETM preparation, for example).

Comments:

- CP-36 is a good proposal, involving total restructuring of the FMWTC facility. A substantial amount of detailed study is needed to develop a solid business case. Note that the ETMs are already in process; this Project proposes to provide the Electronic Classroom.
- CP-36 provides a good opportunity first to evaluate the Electronic Classroom requirements for an entire training facility, and then to acquire, install, use, and test the effectiveness of that Classroom.

CP-37

Candidate Project: Multifunction and Database Support System for Joint Tactical Combat Training System (JTCTS) and Battle Force Tactical Trainer (BFTT)

POC: Debby Young / Dale Lotspeich

Organization: NAWC WD / NSWC PHD

Summary:

CP-37 proposes augmenting existing BFTT IETM databases with embedded operator and maintenance ICW modules for training afloat and for more effective Schoolhouse training.

Characteristics:

- JTCTS is planning to develop an LSAR-based, shared-data system for TMs and training material. BFTT has already published a Class 4 IETM.
- A study is ongoing to identify COTS/ GOTS software for a computer-based training system, designed to optimize the common database for life-cycle maintenance.
- This year, BFTT is building classroom modules for BFTT training, and for BFTT console operation and maintenance.

Expected Payoffs:

- This effort is expected to reduce the traditional Schoolhouse procedure-training time by at least 25 percent, and to reduce traditional instruction time by 50 percent. It has the potential to reduce the use of simulators and mockups.
- If the Training Community agrees to rely on only OJT, deferring Schoolhouse training until after the first tour, this IETM with its requisite training package would increase productivity by 100 percent.

Investment:

\$2 million for:

- Software, hardware, and manpower needed to capture expert's training methodology.
- BFTT unique operations, COTS maintenance, technical, and logistics database.
- JTCTS would expand the initial investment required to standardize the approach between BFTT and JTCTS.

Follow-On Investment

- \$1 million per year for the first 2-3 years.

Comments:

- CP-37 provides a great opportunity to bring a unified Electronic Technical Information Support System into a major new program used by both the Air and the Surface Navy. It could well be a definitive trend setter. Since the JTCTS and BFTT programs are based on leading-edge computer technology, they are amenable to the unified system support approach. The program managers are already committed to all-electronic products and they need support to accelerate bringing the capability up to that of a true unified Electronic Technical Information Support System.
- With its joint NAVSEA/NAVAIR sponsorship and its focus on a unified database, this is an excellent proposal. It is highly recommended for Phase II study.

CP-38

Candidate Project: Using ICW to Meet Training Requirements

Revised Title: Enhance the Shipboard Training Enhancement Program (STEP) by
Incorporating IETMs

POC: Dennis Knott

Organization: NETPMSA (Code 0476)

Summary:

Support the underfunded STEP Program by incorporating linked IETM/ICW modules.

Characteristics:

- The Shipboard Training Enhancement Program (STEP) converts existing Schoolhouse courses to ICW for delivery at the worksite (ship or station).
- The use of STEP has resulted in the cancellation of instructor-led courses at the Schoolhouse.
- The Proposal is to digitize and hyperlink Technical Manuals and reference documentation with IETMs to enhance the training program.

Comments:

The case has not been well demonstrated that including IETMs into existing STEP systems will increase effectiveness. STEP could well be a suitable Program for such an integration, but currently it is not highly dependent on IETMs. CP-38 may prove to have high potential benefit, but more information is needed.

CP-39

Candidate Project: Medium Tactical Vehicle Replacement (MTVR) IETM

Revised Title: Develop an IETM and Associated ICW for the USMC Medium Tactical Vehicle Replacement (MTVR)

POC: LT COL R. C. Eisiminger, DSN 278-2895; CAPT William Mattes, DSN 278-3739 x232; LT COL Wade Yoffee, DSN 484-0833

Organization: USMC

Summary:

Develop an IETM and associated ICW for the USMC MTVR program, a project to remanufacture the Corps' 5-ton trucks.

Characteristics:

- ICW program already funded.
- MTVR is a major USMC program; the vehicle deploys with all three Marine Expeditionary Forces (MEF).
- Usable at proposed learning resource centers and deployable suites.
- Three formal courses support the current version of the truck:
 - A basic course occupying 52 academic days is taught 24 times a year to 40 students each;
 - An advanced course occupying 68 academic days is taught 11 times a year to 26 students; and
 - A logistics vehicle course occupying 17 academic days is taught 10 times a year to 40 students.
- Current facilities support a 40-man Electronic Classroom.
- USMC Instructor Management Schools support increased use of electronic media to include ICW and IETMs.
- The USMC has included requirements in the POM for learning resource centers and deployable suites.

Expected Payoffs:

- Reduced training time.
- Lower student attrition.
- Reduced requirements for life-cycle support of Training Materials.
- Reduced requirement for actual-equipment training aids.
- Reduced storage space for paper Training Materials.
- Better classroom utilization.
- Enhancement of deployment and onboard distance learning.
- Enhanced ICW lessons.

Initial Investment:

- Produce appropriate IETM.
- Link ICW with IETM.

Life-Cycle Investment:

- Update IETM/ICW as needed.
- Provide modernization to learning resource centers and suites as needed.

Comments:

- CP-39 appears to be a good candidate for study, but more information is needed for final evaluation.
- Recommended as the best Marine Corps candidate.

CP-40

Candidate Project: Amphibious Assault Vehicle (AAV)/Light Armored Vehicle (LAV) IETMs
Revised Title: Develop IETMs and Associated ICW for the USMC Amphibious Assault Vehicle (AAV) and Light Armored Vehicle (LAV)

POC: LT COL R. C. Eisiminger, DSN 278-2895; Doug Jones, DSN 278-4269

Organization: USMC

Summary:

Convert existing legacy Technical Manuals for LAV and AAV (currently in WordPerfect format) to IETMs. The AAV IETM will augment the AAV ICW recently completed by NAWC/TSD.

Characteristics:

- AAVs and LAVs are deployed with all three Marine Expeditionary Forces (MEFs). The IETMs and ICW will be usable on proposed USMC learning resource centers and deployable suites.
- Three formal courses would be supported by the AAV IETM:
- Basic maintenance course, 210 students, 70 academic days, given 6 times a year;
- Intermediate maintenance course, 45 students, 65 academic days, given 3 time a year; and
- Basic crewman course, 636 students, given 14 times a year.
- Electronic Classroom would have to be purchased.
- USMC Instructor Management Schools support the increased use of electronic media to include ICW and IETMs.

Expected Payoffs:

- Reduced training time.
- Lower student attrition.
- Reduced requirements for life-cycle support of training materials.
- Reduced requirements for actual-equipment training aids.
- Reduced storage space for paper training materials.
- Better classroom utilization.
- Enhancement of deployed and onboard distance learning.
- Enhanced ICW lessons.

Investment:

- Convert paper TMs to IETM form.
- Link with ICW.

Comments:

CP-40 appears to be good candidate for study, but more information is needed for final evaluation.

CP-41

Candidate Project: AN/STC-2 Technical Manuals and Training Courses

Revised Title: Develop Electronic Technical Information Support System for the AN/STC-2

POC: Bill Warren

Organization: NISE East Det Norfolk Code 5

Summary:

Merging of IETMs, ICW, CBT, and Electronic Classroom for a major revision of AN/STC-2 Technical Information.

Characteristics:

- AN/STC-2 Technical Manuals have recently undergone a major revision. Additionally, NISE East Det has been tasked to develop a Class 3 IETM, an effort which was scheduled to begin in July 1995.
- The AN/STC-2 training course runs between 10 and 12 weeks, and could be cut by 30 to 40 percent by incorporation of electronic training materials. Technical managers believe this course could be eliminated at the San Diego site and replaced by a portable electronic package which could be installed at other schools where mainstream training is accomplished. [AN/STC-2 training is usually relegated to collateral duty for Electronic Technicians (ETs).]

Expected Payoffs:

- Reduce training cost by 35 percent over eight years.
- Reduce course length by 30 to 40 percent.
- Obtain a significant increase in Rate proficiency.
- Eliminate specific school for the AN/STC-2.

Investment:

- Merging of IETMs, ICW, CBT, and Electronic Classroom.

Comments:

More data are needed to fully evaluate CP-41. Discussion with the ISEA indicated the potential for complete elimination of dedicated AN/STC-2 courses; however, PM has not corroborated this intention. Further study is recommended only if that objective can be confirmed.

CP-42

Candidate Project: Ship Self-Defense System (SSDS) MK-1

Revised Title: Onboard Training via Embedded ICW based on IETM for the Ship Self-Defense System (SSDS) MK-1

POC: Bill Henderson, 703-602-3166; Susan Mayberry, 805-982-0037

Organization: PEO (TAD) D; NSWC PHD

Summary:

Develop ICW based on an IETM for training for operation and maintenance of the Ship Self-Defense System (SSDS) MK-1.

Characteristics:

- Develop IETM and associated ICW for the SSDS, (MK-1), a new system for which Schoolhouse training will be moved to the ship.
- The only SSDS operations and maintenance training will be onboard ship, using ICW embedded in equipment consoles.
- The SSDS MK1 program is in the acquisition phase; an IETM and ICW are being developed.
- Installation planned for LSD, LHD, AG, CV, and CVN ships.
- Acquisition of new PCs will not be required to run the ICW or IETM, as they will be embedded in the SSDS command table.
- SSDS will ultimately interface with BFTT, the Advanced Combat Direction System (ACDS), and Cooperative Engagement Capability (CEC).

Expected Payoffs:

- Formal Schoolhouse will not be required.
- Electronic access to specific information via hypertext, hot spots, etc., will be immediate and specific.
- The integration of ICW with the IETM will make the use of the IETM more effective.
- Initial training for LSD 48 is scheduled for June/July 1996.
- As SSDS is introduced to other ship classes, the development of class-specific curricula and IETMs will be facilitated by having training materials already in multimedia modular format.

Investment:

- ICW development, Level 3, 100 hours: \$1,500,000
- IETM development, Level 4: \$ 800,000

Comment:

CP-42 appears to be a very sound proposal. Most components are now under development. It is not clear what additional funding is required. This program may be considered in concert with CP-37 for the BFTT multimedia system.

CP-43

Candidate Project: AN/UYQ-70, Advance Display System (ADS)

Revised Title: Convert Commercial TM and Courseware to IETM and AIM-based Courseware for the AN/UYQ-70 ADS

POC: Herbert L. Pittman, 703-602-1055 x232
FAX 703-602-2070

Organization: NAVSEA 91W5 P3L

Summary:

Develop an IETM and associated AIM-based courseware for the AN/UYQ-70 Advanced Display System (ADS) which will be based on COTS/NDI components.

Characteristics:

- ADS will be deployed on air, surface, and subsurface platforms.
- The major users of the AN/UYQ-70 are AEGIS, Cooperative Engagement Capability (CEC), Advanced Combat Direction System (ACDS), Ship Self Defense System (SSDS), the New Attack Submarine, and NAVAIR E-2 programs.
- It is integrated into the receiving weapon system as the user console, but the maintenance system of the receiving system governs the support of the AN/UYQ-70 Console.
- The AN/UYQ-70 comes with a commercial operation and maintenance Technical Manual, which the ISEA intends to develop into an IETM by the spring of FY 96.
- The system integrator (SI) is developing a commercial operation/maintenance course and an operator course. The ISEA has been tasked to turn the operation and maintenance course into a formal Navy course using AIM-produced courseware.

Expected Payoffs:

- It is expected that HNCs (customer) will save money and training time in the length of their courses. The payoff expected cannot be measured until the system is deployed in the Fleet.

Investment:

- The program office has budgeted funding for the initial development of an IETM.

Comments:

CP-43 would be an excellent candidate if it is possible to design an implementation in concert with a receiving weapon system, e.g., the AEGIS Weapon System. It is recommended that a project based on the planned inclusion in the AWS be investigated, working closely with PMS-400, the AN/UYQ-70 PM, and possibly the AN/UYQ-70 contractor.

CP-44

Candidate Project: Module Test and Repair (MTR)

Revised Title: Upgrade an Existing IETM for MTR to include Onboard Training

POC: R. Dan Rodgers

Organization: NUWC Det, Norfolk

Summary:

Upgrade an existing Class 3 IETM for the MTR to include full-action video and audio with corresponding ICW. Then transfer training from Schoolhouse to onboard training.

Characteristics:

- MTR workstations are located throughout the DOD. The training affects a large number of students throughout DOD.
- Class 3 IETMs have already been developed. Associated automated training is needed to increase training effectiveness.
- Development time will be approximately six months from receipt of funding.

Expected Payoffs:

Transfer the training from Schoolhouse to onboard training. This would free up training classrooms and instructors, greatly reducing Schoolhouse training needs and costs.

Investment:

- Curricula and IETM development only. Hardware is already in place.

Comments:

The potential of CP-44 is very high, because of its wide applicability across the Navy. Additional information is needed on how training courseware would be integrated with the existing IETM.

CP-45

Candidate Project: Sargent Fletcher (ARS-301)

Revised Title: Develop and Link IETM to Existing CBT for the ARS-301 In-Flight Refueling System

POC: CDR Tom Reed

Organization: PMA-205-3C (NAVAIR)

Summary:

CBT for the ARS-301 in-flight refueling system has been developed and is in use at the Schoolhouse, but has not yet been deployed to the IMAs at Fleet squadrons. One TM, currently in paper form, needs to be converted to IETM form and linked to the CBT.

Characteristics:

- The ARS-301 is used by both the Navy and USMC. It is a high-priority system; it refuels the F/A-18 and other aircraft.
- The Project Office is considering use of IETMs.

Investment:

Funding for conversion of the existing Technical Manual to IETM form and integration with current CBT. Hardware is required for classroom and Fleet training sites (approximately 20). Cost estimates are not available at this time.

Comments:

CP-45 involves a small student throughput from 4 teaching sites where IETMs would be critical to the training process. The need for IETMs at user sites in conjunction with the CBT needs to be demonstrated. Pending this classification, CP-45 is not recommended for the study.

CP-46

Candidate Project: Cryogenics IMA

Revised Title: Convert Legacy TMs and Courseware to Integrated IETM and CBT for the Cryogenics Intermediate Maintenance Activity

POC: AMHC Henry

Organization: PMA-205-3C7 (NAVAIR)

Summary:

MCAS Cherry Point teaches intermediate-level cryogenics for all Navy and Marine Corps aircraft. The paper-based courseware is currently under revision. It is proposed to convert the paper TM and course material to an integrated IETM/CBT package.

Characteristics:

- Cryogenics courses taught at MCAS Cherry Point train the intermediate-level technician in handling and maintaining equipment related to liquid oxygen (LOX); gaseous oxygen (GOX); and gaseous nitrogen (GN₂).
- The course supports Navy/Marine Corps air and surface programs, including instruction for Depot personnel; it is also multi-Service.
- No electronically displayed Technical Information is available for training or the TM, but courseware revision is in process.
- Annual throughput of 210 students, with seven courses at one site.

Comments:

- As submitted, CP-46 has no electronic resources, funded or planned. There seems to be a relatively small payoff potential.
- Not recommended for further consideration under this study.

CP-47

Candidate Project: F/A-18 Weapon Systems IETM Integration at NAMTRAGRU

Revised Title: Convert Legacy Data to IETMs and Use the IETMs to Develop CBT for the F/A-18 Weapon Systems

POC: Roger Robinson

Organization: NAVAIR 3.6.1.2

Summary:

- Use the Automated Conversion System (ACS) and Aircraft Maintenance Integrated Diagnostic Demonstration (AMIDD) authoring systems to develop a Class 4/5 IETM database. Use AIM/IETM to develop Instructor and Student Guides for the Schoolhouse, and CBT for the squadrons.
- Specifically, it is proposed to use ACS to digitize legacy data, and then to use AMIDD's non-proprietary authoring and presentation system to develop a Class 4/5 IETM database. The IETM database would be the source which the AIM/AIM II courseware authoring system would use to prepare the Computer Based Training (CBT) package.
- AIM would also download data from the IETM database to assist in the development of Instructor and Student Guides for Schoolhouse training. CBT, based on the IETM database, would also provide in-service training.

Characteristics:

- Throughput for FYs 93, 94 and 95 was approximately 3,500 students for 12 F/A-18 weapon system-related courses.
- The authoring and presentation systems were scheduled for July 1995. ACS deliverables will be available FY 96.

Expected Payoffs:

- Improve effectiveness of maintenance by 15 to 30 percent
- Reduce training time to complete segments of a pipeline for approximately 5,000 students during a three-year period (estimates based upon data collected from the Schoolhouse).
- Maintain a higher level of readiness by using the same IETM and CBT at both the schoolroom and the squadron, and effectively reduce the overall Fleet requirement by one maintainer per aircraft.

Comments:

CP-47 is a proposal to prepare IETMs and CBT for the entire aircraft. As such, the effort may be too large a project for this study. CP-31, which involves a single F/A-18 system, could serve as a first assessment for this larger effort.

8.2 DATABASE SUPPORT FOR CONTRIBUTIONS TO EVALUATION OF CANDIDATE PROJECTS (CPs)

8.2.1 *Reasoning Behind Developing a CP Database*

The Phase I Candidate Project (CP) evaluations were supported by various aids, such as a database of key CP characteristics. The database provided the study team with information that helped to apply the evaluation criteria. For example, Criteria 2 and 5 relate to the CP's state of development in general, and key elements in particular; i.e., they imply the question: Do the states of development of IETMs and of automated training capabilities provide savings within a three-year window of opportunity? The fields of the database recorded development states for IETMs and for automated training capabilities; e.g., ECR, CBT, and ICW.

The database provided further support in making it easy to consider combinations of CP characteristics, rather than only one characteristic at a time. Characteristics are more helpful when considered in combination; e.g., What are the states of development of a CP's IETMs and of its CBT/ICW?

A final reason for the database concerns the dynamic state of the CP evaluation, especially as it moves into Phase II. As the evaluation proceeds, it is expected that more evaluation considerations will be added; e.g., dollar values for payoffs and indications of return on investment. In addition, it is expected that, in working with the study team, some submitters will modify or otherwise change their original submissions; e.g., will add new elements suggested by the team, add life-cycle payoffs, and/or modify the states of developments for IETMs, CBTs, or ICW. The database was developed because it is easier to modify and update than are fixed aids such as lists, tables, or matrices.

In support of these evaluations, the study team initiated the development of the CP database. paragraph 8.2.2 describes the CP characteristics, or "fields", chosen for inclusion in this initial version of the database.

8.2.2 *Initial Data Fields Used to Define the CP Database*

Presently, the CP database includes 15 "character" fields and one "memo" field (character fields can be queried; memo fields cannot). These fields are generic CP characteristics such as a submitter's name and organization, the status of IETMs, the type of automated training proposed, and the extent to which an IETM covers a weapon. The database is built by making entries in the cells formed by the intersections of generic-field columns with the 47 CP rows; e.g., ICW or CBT is entered in the cell formed by the intersection of the **TRNG_TYPE** column and each **CP-n** row. When all possible entries have been made for all CP records, the database is ready to be used; that is, the database can be queried as to its contents.

Table 17 defines the generic fields of the present database, and all of the specific data entries which are possible for each field.

8.3 REVIEW OF CANDIDATE PROJECTS BY THE OFFICE OF NAVAL RESEARCH

At the request of the Special Assistant to the ASN(MR&A), the package of 47 Candidate Projects was submitted to ONR, Code 342. Comments and suggestions received as a result of this review have been submitted to OPNAV N71/N81.

Table 17. Field Definitions for Candidate Project Database

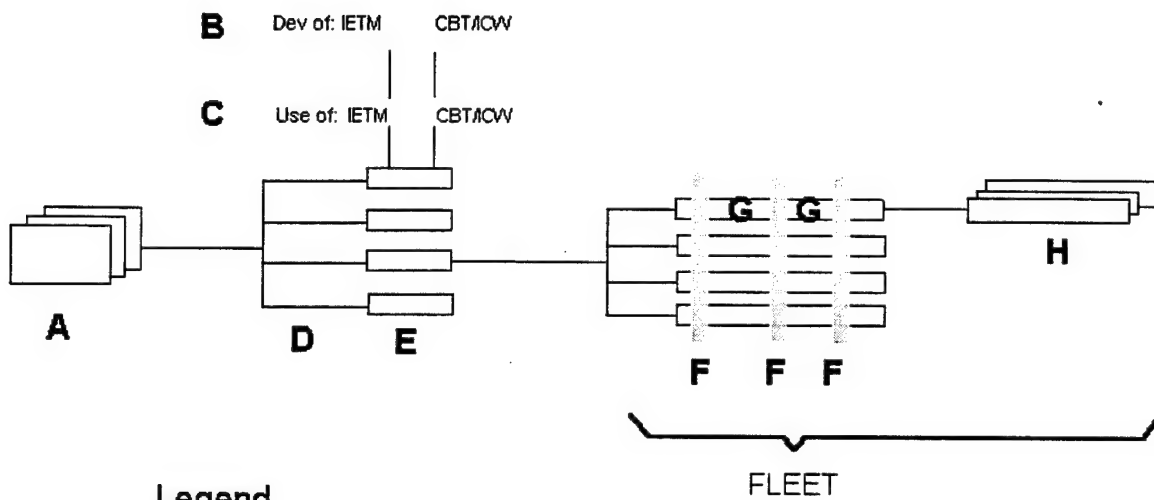
	General Field Name	Definition and Cell Entries
1.	NAME	Name of submitter; e.g., the POC.
2.	ORG	Organization of submitter.
3.	WARFAREA	Warfare area. One of 7 categories; e.g., Subs, Air.
4.	IETMSNOW	What is the status of the proposed IETM? Y - Exist now; U - Underway; PL - Planned before study; PR - Proposed at study.
5.	COVNOW	Coverage now. What portion of the system do/will IETMs cover? P - Partial or F - Full.
6.	SPEFFECTS	Special effects. Identifies IETM characteristics over and above specifications. Examples are: Exp System, VE, Link to PMS or to Performance Monitoring/Fault Localization.
7.	CLASSNOW	Which class for existing/underway IETMs. 1, 2, 3, 4, 5.
8.	CLASSFUT	Which class for planned/proposed IETMs. 1, 2, 3, 4, 5.
9.	TRNG_TIMIN	What is the timing/status of the electronic training? EB4S. Existed before study. PB4S. Included as part of an official plan that existed before the study. NWS Training proposed at the Workshop.
10.	TRNG_IETM	What is the relationship between training and IETM? Integrated. As in "Training is a part of IETM." Linked. As in "CBT is separate from, but linked to, IETM." Embedded. As in "Embedded in weapon system." IETMs. As in "IETMs are the instruction content guided by IGs and SGs."
11.	TRNG_TYPE	Type of training proposed: CBT, ICW, or ECR.

Table 17. Field Definitions for Candidate Project Database

(cont'd)

	General Field Name	Definition and Cell Entries
12.	IMPACTAREA	<p>Any of eight impact areas in the training continuum. (See Figure 2 for a diagram which permits identifying CP impact in the training continuum.)</p> <p>AA School.</p> <p>BTechniques for developing IETMs or training; e.g., from a single database.</p> <p>CHow IETMs/training materials are used in the training process.</p> <p>DRating Merges.</p> <p>F.....In-service training.</p> <p>GOperations and maintenance.</p> <p>H..... Group training; e.g., JSIMS, BFTT.</p>
13.	EXTOFIMPACT	<p>Extent of impact. Can vary from 1 system/platform/school to cross Services:</p> <p>1platform.</p> <p>1school.</p> <p>Xplatforms.</p> <p>XNavy.</p> <p>XServices.</p>
14.	DEVTOOLS	Includes training development tools (e.g., AIM, ICONAUTHOR) and IETM tools (IDE/AS, proprietary).
15.	RATEMERGE	<p>Is a Rating merge involved?</p> <p>Yes or No.</p>
16.	MEMO	A brief description of key points/questions.

KEY EVENTS IN TRAINING CONTINUUM



Legend

- A A schools
- B Curriculum and IETM development techniques
- C Use of IETMs & ICW/CBT in training
- D Pipelines , e.g., Ratings and NECs
- E C schools
- F In Service Training
- G Operations and Maintenance
- H Group Training

Figure 2. Candidate Project Impact Areas In The Training Continuum

9.0 CONCLUSIONS AND RECOMMENDATIONS

This section presents:

- a. Technical conclusions reached concerning the potential payoffs resulting from the application of IETMs and IETM-based course material to Navy Schoolhouse and in-service training;
- b. Recommendations for tasks to be carried out in Phase II of the current study; and
- c. More general recommendations leading to improved applicability of IETMs to Navy training.

These conclusions and recommendations are based on:

- a. Analysis of information gathered during site visits and the Workshop, and other information provided by members of the Navy Training Community, including documents reporting various types of experience in preparing and using automated electronically presented courseware.
- b. Analysis of the detailed responses to the 15 potential-use Hypotheses circulated for assessment, estimates of payoffs resulting from such uses, and associated comments provided through the Hypothesis-Assessment questionnaires.
- c. Analysis of the 47 proposed Candidate Project writeups covering a wide variety of IETM applications that are summarized in section 8 of this report. In some cases, these analyses are based on a study of more lengthy submissions provided since the Workshop, which include additional discussion and supporting information.

9.1 CONCLUSIONS

9.1.1 *IETM Potential in Training*

Interactive Electronic Technical Manuals, broadly defined as the Interactive Electronic presentation of suitably prepared and formatted Technical Information, have a high potential for streamlining the Navy technical training process, for reducing training costs and time, for simplifying training-associated logistics, and for reducing operational risk in an era of disproportionate downsizing of the Navy Training Community. This potential will be most effectively realized when the IETM is integrated with other automated systems, including course-material preparation, display, course management, telecommunications, management information systems, and integrated database systems.

9.1.2 *Existence of High-Quality Candidate Projects Available for Phase II Analysis*

The Navy Training Community concurs that the use of IETMs integrated, with automated courseware, will provide a significant payoff in training effectiveness, and the Training Community has submitted to the study a wide spectrum of "Candidate Projects" in this area, many of which will be excellent choices to serve as the basis for Phase II analyses.

9.1.3 *Establishment of Navy IETM Policy and Standardization*

To fully exploit the capabilities of IETMs in Navy training, attention must be given to the assurance that the IETM-based material is properly constructed, and that appropriate measures are put in place to control its use and maintenance. Standardization of automated course material, and of its presentation in the Schoolhouse and in the Fleet, is important to assure portability of such material throughout the Navy Training Community.

9.1.4 *Achievement of Integration of IETMs and Automated Courseware*

To properly integrate Technical Information directed toward maintenance or system operation with Technical Information designed for training will require greatly improved cooperation of the efforts of currently separate and often non-communicating staffs. Although this type of cooperation is basically the purpose of the Integrated Logistics Support (ILS) concept, it has frequently not been achieved, to the detriment of both training and maintenance functions of the resulting Technical Information.

9.1.5 *Need for Establishment of an IETM Support Infrastructure*

To effectively exploit the use of IETMs and other courseware-automation measures in Navy training, it is essential that an adequate Navy-wide logistics-support infrastructure, which includes the Schoolhouses, be established.

9.1.6 *Need for RDT&E Support*

The initiation of an integrated IETM/ICW technology into the Navy Training Community should be supported by a suitably designed RDT&E program to assure effective application of this rapidly advancing technology. Areas in which additional RDT&E effort would be of value are the following:

- a. Establishment of the applicability of specific multimedia to integrated IETM/CBT training materials (e.g., video, sound, animation) in terms of training payoff.
- b. Improvement of authoring procedures for combined IETM/CBT training materials in order to:
 - produce the most effective data transfer;
 - access the distributed databases; and
 - improve telecommunications, graphical user interface, and multimedia capabilities.
- c. Establishment of the applicability of virtual environments in training materials, and assessment of the resulting cost/benefit.
- d. Establishment of the requirements for Navy, Schoolhouse, and in-service training infrastructures for the management and update of IETM-based training materials (including hardware and software).
- e. Establishment of requirements for standardization at all steps of the production and use of IETM-based training materials (authoring, control, display, and CMI).

9.2 RECOMMENDATIONS FOR PHASE II

9.2.1 *Proposals Recommended for More Detailed Analysis*

A major purpose of the current study is to identify a series of ongoing efforts or proposed efforts related to the use of IETMs and IETM-based courseware, capable of effecting greater efficiency in an austere era of Navy training. It is the intent of OPNAV to select representative projects from this group to form the basis of the OPNAV (N71 and N81) training input to POM '98 (or, possibly, earlier budget submissions where suitable near-term proposed or on-going projects offer significant training payoffs).

Accordingly, a preliminary screening of the 47 Candidate Proposals has been carried out, in which the project descriptions (generally as written, with occasional supplemental material submitted) have been compared with the Selection Criteria listed in Tables 13 and 14. (Summaries of the Candidate Proposals, with initial comments, have been enclosed in this report as section 8.)

The entire package of Candidate Projects has been submitted to OPNAV (N71 and N81) for their assessment and selection for sponsorship during the POM process. It is recommended that the list of Candidate Projects selected by OPNAV be subjected to more detailed cost/benefit analysis during Phase II of the study.

It was considered that some of the Candidate Projects either lacked sufficient data at the time of submission to permit final assessment of their relevance for Phase II analysis, or (as written) were not directly in the scope of the study, which is directed toward identifying those projects representing the widest possible application of advanced training technology to the Navy's changing technical requirements and possessing a readily identifiable, relatively short-term payoff.

It is recommended that the list of Candidate Projects selected incorporate at least one of each of the following five categories:

- a. A Schoolhouse IETM initiative.
- b. A new-start weapon-system initiative.
- c. An initiative involving leading-edge technology (e.g., VE, Expert Systems, telecommunications).
- d. An initiative involving training of specific Ratings.
- e. An initiative involving training for intermediate and Depot maintenance.

It is, however, a conclusion of the study that essentially all of the proposed efforts submitted would be of significant benefit to the Navy's training program over a wide spectrum of applications.

9.2.2 *Cooperative Analysis of Selected Candidate Projects*

Our original proposed effort for Phase II was based on the assumption that we would follow up in detail a very small number of projects. We suggest a slight adjustment in approach in

order to follow up with a greater number. This new approach would be for the study team to develop detailed guidance for preparing a business case specifically targeted at more specific N-7/ASN(M&RA) objectives. Our role would then be to advise the program managers in their performing the actual data gathering and assembling of the quantitative information needed. NSW/CD would lead the cooperative team in analyzing the data and developing the business case. We would then coordinate the actual submissions and work with the submitters to be sure that their Candidate Projects for the business-cases analyses were all accurately and completely described.

9.2.3 *Phase II Milestones*

We additionally propose that the Phase II effort be aimed at two key milestones. One is to provide a completed assessment of the potential payoff of each Candidate Project by the first week in November 1995, so that it could be used in the N-7 training review. The second milestone would be to have available in March 1996 the finished business cases for selected Candidate Projects, outlining all investments, payoffs, and secondary impacts in a form to fully support a POM'98-issue paper.

9.3 ADDITIONAL RECOMMENDED EFFORTS

9.3.1 *Further Study of Non-Selected Candidates*

Even if the scope of Phase II is expanded to include as many as 7 or 8 Candidate Projects for further study, there will remain for consideration many very solid proposals which appear to have a high likelihood, if implemented, of yielding net benefits to the Navy. However, these non-selected proposals all need additional detail and, in some cases, restructuring and rescoping in order to better utilize technology, and to be capable of being properly evaluated for funding by N-7. We strongly recommend that N-7 consider sponsoring an effort to systematically investigate not only the non-selected Candidate Projects in the "Excellent" and "Good" categories, but also the proposals in the "Have potential but need more data" category, with a goal of having a more complete slate of proposals for future funding if and when the opportunity arises. We recommend that this effort be of longer duration than the Phase II study to allow time to restructure, refocus, and rescope many of the proposals in line with the long-range objectives and technology-advancement goals of N-7.

9.3.2 *Proposed Further Evaluation of Hypotheses*

During Phase I, a significant amount of effort was spent in preparing and obtaining evaluations from the Navy Training Community of the 15 Hypotheses for achieving training benefits by using IETMs and IETM-based training materials. While we were not able to continue this work during the second half of the Phase I effort, we recommend that further evaluation of those Hypotheses be undertaken so as to formulate recommendations for developing

management and policy instruments in N-7. These instruments, for example, could be used to defend and select future proposals for uses of IETMs in training.

9.3.3 Evaluation of Issues Involved in Accelerated Use of IETMs for Training

During the conduct of the Phase I study, several IETM-related issues were identified by members of the Training Community. Nine such issues were identified as major issues during the Workshop and were included in the Workshop report. Limitations in time and resources in the Phase I effort did not permit us to address these issues in sufficient depth or to properly identify other related issues. We recommend that an additional study effort be focused on these issues related to IETMs and other "paperless" training products, and that certain policy statements be proposed for N-7 to manage the transition to the digital training world.

9.3.4 Standardization of IETM-Based Training Materials

We also recommend that a study be performed to address the requirement for some levels of standardization of IETM/training integration and possibly, by extension, the need to standardize the IETM products that are, in fact, being procured primarily for training purposes.

9.3.5 Evaluation of High-Risk, High-Payoff Initiatives

Because of the low-risk, short-term payoff emphasis of this study, few innovative but high-risk Candidate Projects were put forth for consideration. ONR is funding several initiatives in the 6.1/6.2 R&D area that are directed at such high-risk/high-payoff training objectives. However, these R&D efforts do not typically or automatically emerge as available training products. It is strongly recommended that N-7 look at the possibility of extending some of this basic research into useful products. In larger projects, such as the development of a weapon system, this process would involve an expensive and lengthy 6.3 effort; however, in the training area, some of the 6.2 technology could transition into useful products without much additional R&D.

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APPENDIX A

DEFINITIONS AND LIST OF ACRONYMS

USED IN THIS REPORT

A-School..... A basic technical school for enlisted technicians (generally at the apprentice level) which follows Recruit Training and precedes C-School.

AIM **Authoring of Instructional Material.** An automated system for developing instructional material, developed by the Naval Personnel Research and Development Center, and maintained by NAWC/TSD.

AIMS..... **Automated Information Management System.** An IETM-authoring system developed by Hughes Aircraft.

AMIST..... **Aviation Maintenance In-Service Training.** A Navy program which provides technician training between initial and career C-School increments, and after C-School, to maintain a sustained skill level.

ATC **AEGIS Training Center.** Located at NSWC, Dahlgren, Virginia.

ATIS **Advanced Technical Information Support (System).** A system in which legacy TMs have been digitized, recorded on CD-ROMs, and distributed to ships with an associated access system for electronic display or Print-On-Demand. An ETM system.

ATSG..... **AEGIS Training Support Group.**

CAI **Computer-Aided (or Assisted) Instruction.** That part of CBT making use of the computer in the actual presentation or display of information by an instructor, as in an Electronic Classroom (ECR).

CANTRAC..... **Catalog of Navy Training Courses.** (Available on CD-ROM.)

CAT **Computer-Assisted Training.** See CBT.

CBI..... **Computer-Based Instruction.**

CBT **Computer-Based Training.** An instructional method that uses a computer to develop, deliver, and/or manage training materials and training process.

- a. The provision for, and use by, instructors of instructional graphics [These are called Instructional Graphics Training Devices (IGTDs).]
- b. Interactive Courseware (ICW), primarily for in-service training where the student (unsupervised by an instructor) interacts with the information provided and proceeds at his own pace.
- c. Computer Managed Instruction (CMI); i.e., automated systems (tests, scores, records) to manage the instruction process.

- CD-ROM Compact Disk - Read-Only Memory.** The medium on which digitized information (such as an IETM) is in general recorded in a form which may be read by a computer-controlled display device.
- CMI..... Computer Managed Instruction.** The automation of the administrative aspects of training, involving administration of tests or assembly of test scores, maintenance of training records, and the like. See CBT.
- CNET..... Chief of Naval Education and Training.**
- CNTECHTRA..... Chief of Naval Technical Training.** A Navy Activity previously in charge of C-Schools. Disestablished in 1993. C-Schools are now controlled directly by CNET.
- Core and Strand Training [1] A training approach in which all students study the same basic (core) material, and then are divided into separate course to study more specialized (strand) material. [2] Career training, furnished to an experienced apprentice, that provides requisite knowledge and further develops skills to permit independent work.**
- C-School A system-oriented school which trains technicians in the operation and maintenance of specific weapon, or other, systems. C-School graduates are fully qualified in their fields, which are described in terms of Navy Enlisted Classification (NEC) number.**
- ECR Electronic Class Room.**
- ETM..... Electronic Technical Manual.** A Technical Manual which has been digitized in either bit-map or ASCII form. It may contain extensive linking of information modules, but, in general it is not interactive (does not contain a Graphical User Interface) and it has not been optimally formatted for screen presentation.
- FREST..... Fleet Replacement Enlisted Skills Training.**
- GMT..... General Military Training.**
- ICAS Integrated Condition Assessment System.** A system installed on Navy ships which permits a technician to monitor the operating condition of shipboard systems by means of a series of built-in sensors. KAS data can be downloaded to on-board PCs.
- ICW..... Interactive Courseware.** Computer-controlled, interactive training material designed for self-paced use by a trainee outside the classroom.

IETM.....Interactive Electronic Technical Manual. The following definition has been taken verbatim from paragraph 6.4.10 of *MIL-M-87268 Military Specification. Manuals, Interactive Electronic Technical: General Content, Style, Format and User-Interaction Requirements*, 20 November 1992:

A Technical Manual, prepared (authored) by a Contractor and delivered to the Government, or prepared by a Government Activity, in digital form on a suitable medium, by means of an automated Authoring System; designed for electronic-window display to an end user, and possessing the following three characteristics:

- a. The format and style of the presented information are optimized for screen presentation to assure maximum comprehension; that is, the presentation format is "frame-oriented", not "page-oriented".**
- b. The elements of Technical Information constituting the TM are so interrelated that a user's access to the information he requires is facilitated to the greatest extent possible, and is achievable by a variety of paths.**
- c. The computer-controlled TM-Display device can function interactively (as a result of user requests and information input) in providing procedural guidance, navigational directions, and supplemental information; and also in providing assistance in carrying out logistic-support functions supplemental to maintenance.**

Although the IETM Specification cited above was written primarily to establish requirements for Technical Manuals used by Fleet and flightline technicians to maintain, operate, and provide logistic support for weapon and other hardware systems, the fundamental principles cited in the broad definition given here are completely applicable to the preparation of Schoolhouse and On-the-Job training materials, both general and system-related.

Thus, as used in this study, the term "IETM" will apply to all substantive materials designed for interactive electronic display by means of a PC-controlled terminal, either instructor-controlled or self-paced, for any aspect of training, from the most basic to the most detailed system-related packages.

Such IETM training material also can be integrated with the functions of computer-based training, such as drills, checklists, tests, record-keeping, and the establishment of various types of training-audit trails.

IG.....Instructor's Guide
IGTDInstructional Graphics Training Device.
ILS.....Integrated Logistics Support.
IMDR.....Instructional Media Data Report.
Initial Training.....Training normally applied to the first-term enlistee, which supplies the basic knowledge and skill required to perform warfare-related tasks under supervision.
INTRPD.....Integrated Navy Training Requirements and Planning Database.
ISTIn-Service Training. Deployable training. Includes On-Board Training (OBT) and On-the-Job Training (OJT).
JPA.....Job Performance Aid.
Just-In-Time Training.....A term applied to training which is deferred until a period shortly before the skill involved will be required, as contrasted with training carried out on a uniform, pre-arranged schedule, independent of technician assignment.
MOS.....Military Occupation Specialty.
MTIPMaintenance Training Improvement Program of NAMTRAGRU. It is a training program designed to identify and correct technical deficiencies in maintenance personnel at the organizational and intermediate levels, through objective diagnostic refresher training.
NALCOMISNaval Aviation Logistics Command Management Information System.
NAMTRAGRUNaval Air Maintenance Training Group, located at NAS Memphis, Millington, Tennessee.
NAWC/TSD.....Naval Air Warfare Center/Training Systems Division, Orlando, Florida.
NECNavy Enlisted Classification (Number).
NITRAS.....Navy Administrative Training Resources System, an administrative system for training-course management.
NTPNavy Training Plan.
OTTOffice of Training Technology, OPNAV.
PQS.....Personnel Qualification Standard.

Rate..... The paygrade of an enlisted technician within a given Rating, ranging from paygrade E4 (3rd Class Petty Officer) through E-9 (Master Chief).

Rating..... One of 60-70 technical job classifications (occupational fields) in the Navy; e.g., Yeoman, Aviation Machinist's Mate, Engineman. Not to be confused with Rate.

Refresher Training..... A training process used to correct an identified deficiency.

STAS **Student Training and Accounting System**, an automated course-management system.

TG..... **Trainee Guide**

TPDMP..... **Training Program Development and Management Plan.**

TQI..... **Total Quality Instruction.** Emphasizes Remediation.

VTT **Video Teletraining, of the Navy.** A satellite-based distance-training system.

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SEA-04TD (H FELSEN)	1		
SEA-92L1 (C HAINES)	1	NONE	
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